

# CEREAL SCIENCE *Today*

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NOVEMBER 1960

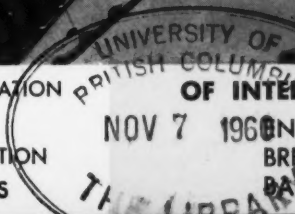
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AN OFFICIAL PUBLICATION  
OF THE  
AMERICAN ASSOCIATION  
OF CEREAL CHEMISTS

OF INTEREST THIS MONTH

NOV 7 1960

ENZYMES IN BREAD PRODUCTION  
BREAD AROMATICS  
BAKING TECHNOLOGY IN GERMANY





# GLOSS *Paramount Style*

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**THE PROBLEM:** *find a better hard butter.* Durkee's Technical Research Staff set out to find one. They wanted a hard butter that would produce confectioners' coatings with better performance characteristics than existing coatings. Specifically, they wanted high gloss retention, greater stability and resistance to bloom under all temperature conditions.

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plant with miniature equipment to simulate actual plant conditions. As a result, a hard butter for making coatings that met every industry requirement was developed. Durkee named it Paramount; confectioners call it "wonderful".

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# The Roche Review Of Enrichment Requirements

for Cereal Grain Foods in the United States

All figures represent milligrams per pound

PRODUCT	Thiamine (B <sub>1</sub> )		Riboflavin (B <sub>2</sub> )		Niacin		Iron	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Enriched BREAD or other <i>baked</i> products	1.1	1.8	0.7	1.6	10.0	15.0	8.0	12.5
Enriched FLOUR <sup>1</sup>	2.0	2.5	1.2	1.5	16.0	20.0	13.0	16.5
Enriched FARINA	2.0	2.5	1.2	1.5	16.0	20.0	13.0	*
Enriched MACARONI & NOODLE Products <sup>2</sup>	4.0	5.0	1.7	2.2	27.0	34.0	13.0	16.5
Enriched CORN MEALS	2.0	3.0	1.2	1.8	16.0	24.0	13.0	26.0
Enriched CORN GRITS <sup>3</sup>	2.0	3.0	1.2	1.8	16.0	24.0	13.0	26.0
Enriched Milled WHITE RICE <sup>4</sup>	2.0	4.0	1.2**	2.4**	16.0	32.0	13.0	26.0

\* No maximum level established.

\*\* The requirement for vitamin B<sub>2</sub> is optional pending further study and public hearings because of certain technical difficulties encountered in the application of this vitamin.

1 In enriched self-rising flour, calcium is also required between limits of 500-1500 mg. per pound.

2 Levels allow for 30-50% losses in kitchen procedure.

3 Levels must not fall below 85% of minimum figures after a specific test described in the Federal Standards of Identity.

4 The Standards state that the rice, after a rinsing test, must contain at least 85% of the minimum vitamin levels. The Governments of Puerto Rico and the Philippines also require this rinsing test. If the method of enrichment does not permit this rinsing requirement to be met, consumer size packages must bear the statement, "Do not rinse before or drain after cooking." Rice enriched by the Roche method will meet the rinsing test. The South Carolina law does not require a rinsing test on packages less than 50 pounds, as the rice in small packages is presumed to be sufficiently clean.

The maximum and minimum levels shown above for enriched bread, enriched flour, enriched farina, enriched macaroni, spaghetti and noodle products, enriched corn meal and corn grits and enriched rice are in accordance with Federal Standards of Identity or State laws. Act No. 183 of the Government of Puerto Rico requires the use of enriched flour for all products made wholly or in part of flour, including crackers, etc.



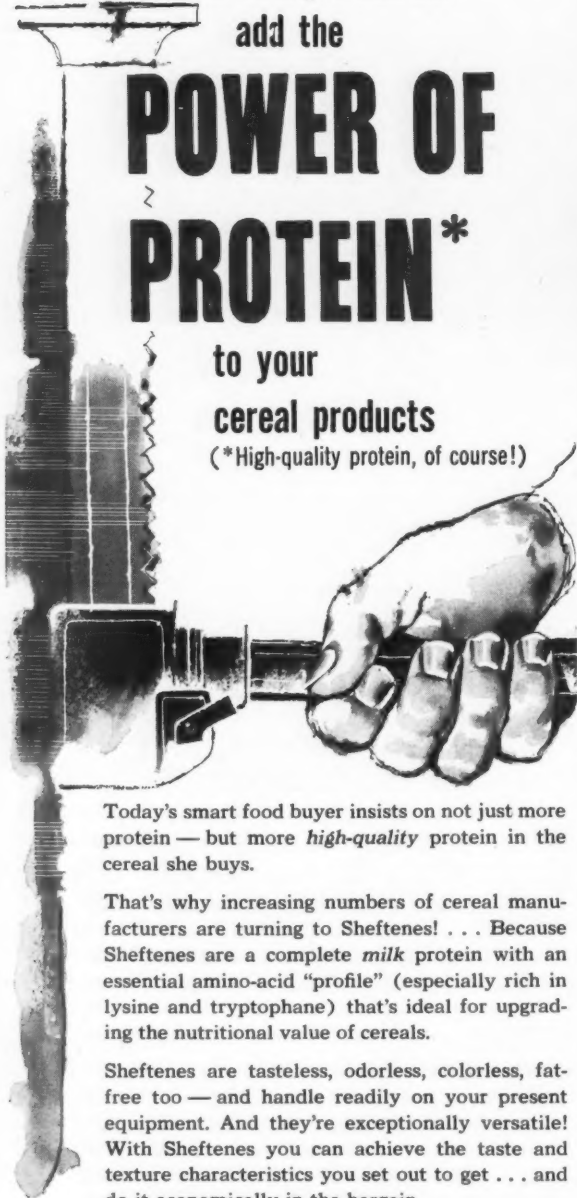
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## PURPOSE OF THE ORGANIZATION

The American Association of Cereal Chemists is devoted to: 1) the encouragement of scientific and technical research on cereal grains and their products; 2) the study of development and standardization of analytical methods used in cereal chemistry; 3) the promotion of the spirit of scientific cooperation among all workers in the field of cereal chemistry; 4) the maintenance of high professional standards of its membership; and 5) the encouragement of a general recognition of the value of the chemist and biologist to the cereal industries.

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# CEREAL SCIENCE

*Today*

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COVER: "Worm's-eye" view of a Minneapolis grain elevator.

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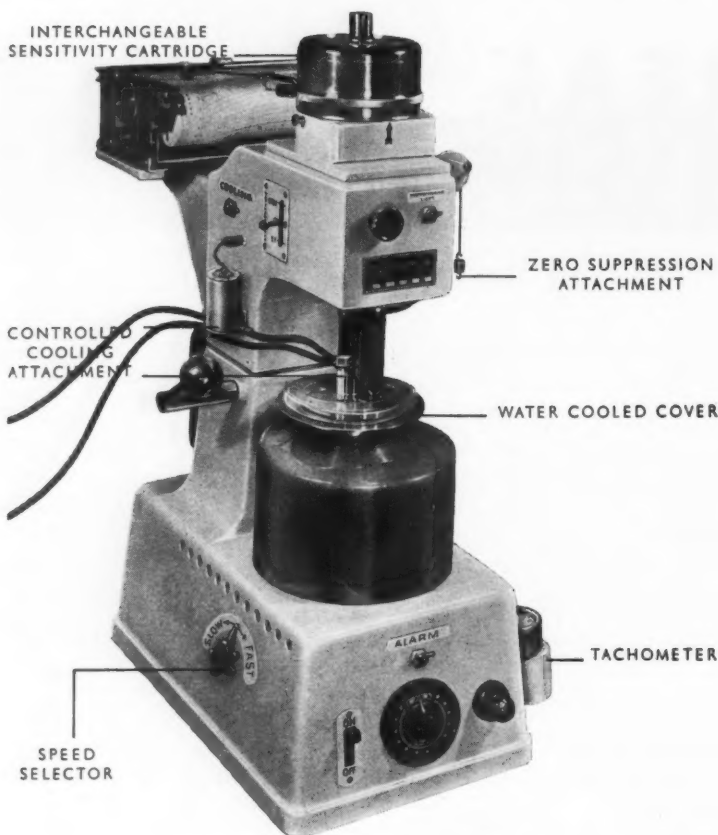
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## Editorial

**P**REPARATION OF LABORATORY methods manuals is an important service performed by and for chemists. With several major "breakthroughs" in analytical techniques in recent times and with new products and applications continually appearing, the task of keeping a methods manual current and useful is much more difficult than formerly. One answer to this problem is looseleaf binding, so that revisions and additions can be made frequently and without the need for complete reprinting. The new edition of the AACC's *Cereal Laboratory Methods* now being prepared will appear in this form.

Methods manuals may be designed to serve any one or a combination of several purposes. "Official methods" used by government regulatory agencies enjoy a unique legal status and are accepted largely on the basis of their demonstrated precision. The same is largely true of those methods adopted by an industry to form the basis for trading rules and practices, thus minimizing controversy between buyers and sellers. In contrast to these, so-called "production methods" used for process and quality control may sacrifice some precision to save time or achieve economy. The time that elapses between receiving a sample in the laboratory and obtaining a result that can be the basis for appropriate action may sometimes make the difference between a useful and a useless procedure. Cost of making a determination may become very significant, especially in a laboratory performing thousands of similar analyses annually.

Omission of needed methods can be an obvious shortcoming in a laboratory manual. Inclusion of little-used or obsolete procedures may be less apparent, but adds unnecessarily to the cost of publication. *Cereal Laboratory Methods* can meet cereal chemists' highest expectations only if the committee preparing the book can have the interest and fullest cooperation of all AACC members.

PAUL E. RAMSTAD

THE ROLE AND  
IMPORTANCE OF

# Enzymes in Commercial Bread Production

By Gaston Dalby, Ward Baking Company, New York, N. Y.

THE ROLE OF the amylases and proteases from cereal, fungal, and bacterial sources in baking has been discussed in a large number of papers during the years. Recently Prouty (4) has written an excellent review of the subject, and Geddes (1) has discussed the role of the enzymes in baking in a general paper on cereal chemistry problems.

Cereal chemists are not in complete agreement on the most satisfactory testing procedure for malt level in flour. It is a problem for commercial bakers to decide on the best specification for malt level in whatever manner it may be determined. The baker is interested in the malt level that will perform to the best advantage in all stages of the manufacture and for the shelf-life of the bread.

Until recently it had been considered that very high levels of cereal alpha-amylase were not harmful. For example, Johnson and Miller (3) reported that the safe upper limit of malt supplementation could exceed 24 times the normal concentration of 0.25% wheat malt in the flour. Geddes (1) now reports, however, that "over-supplementation may lead to a gummy, sticky crumb because the alpha-amylase of wheat and barley is quite thermostable and is not inactivated in the baking oven before gelatinization of the starch (which is very susceptible to amylase attack) has commenced." Prouty (4) points out that "since the fungal amylases are destroyed earlier (approximately 3 to 4 minutes earlier) in the baking stage, there is considerably less danger of over-dextrinization of the starch from fungal enzymes."

In addition to gummy crumb,

high cereal amylase levels lead to loaf fragility at the depanning stage and during transfers from cooler to conveyer, and at the slicing and wrapping machine. High cereal amylase adds to the problem of slicing, owing to the gumminess of the crumb. These factors cannot be put into numbers, but in the long run can be determined by percentages of crumbles.

The activities of two samples of cereal malt, wheat and barley, have been investigated. Results are as follows:

	Wheat Malt	Barley Malt
SKB units per gram	17.1	58.5
Protease (Hemoglobin units)	< 10	< 10

Supplementation of unmalted flour with equal alpha-amylase units, whether from wheat or from barley, produces identical amylograph responses. Figure 1 shows the relationship of amylograph Brabender units to units of amylase supplementation. This relationship will hold, of course, only

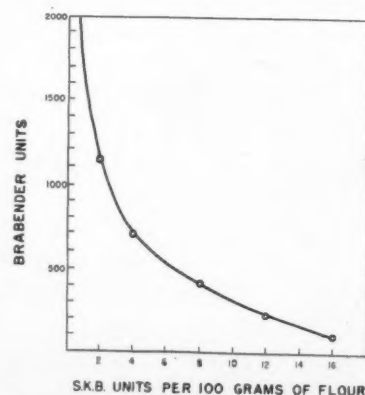


Fig. 1. Relationship of amylograph Brabender units to units of amylase supplementation.

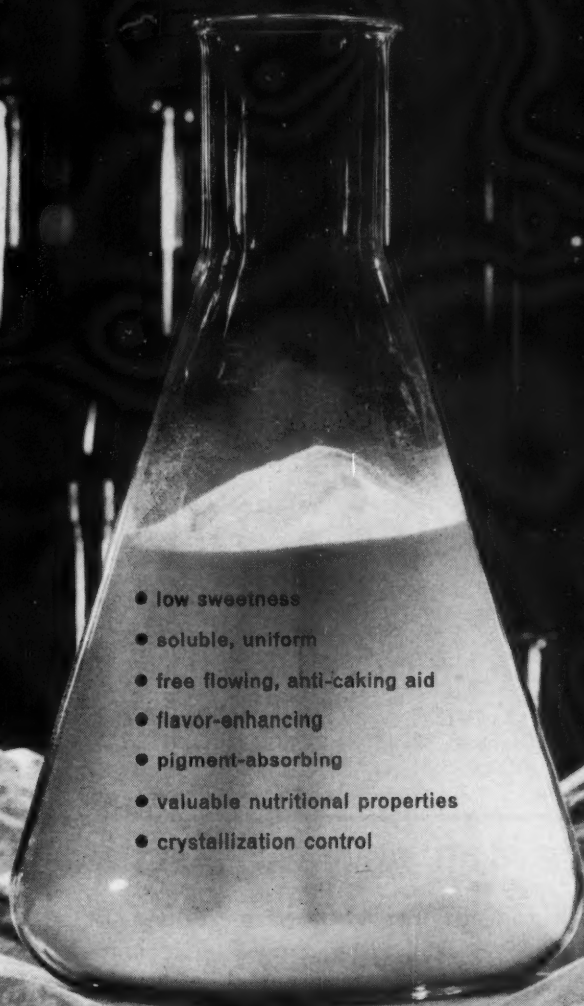
for the amylograph used. Other instruments will produce somewhat variable results because of the problem of the exact calibration of the machine.

It is interesting to compare, in activity units, the results of cereal malt supplementation with fungal enzyme supplementation. The table below shows such a relationship. Commercially available enzyme tablets were used for this comparison.

	Added Alpha-Amylase SKB units/cwt. flour	Hemoglobin units/cwt. flour
0.4% wheat malt to produce 480 B.u. on the amylograph	3,100	< 1,800
One fungal tablet (low protease)	3,550	14,900
One fungal tablet (high protease)	3,550	42,000

Cereal malt is comparatively a poor source of protease. The proteases in cereal malts are not thoroughly understood. Hemoglobin unit measurements indicate a very low level of activity. Hildebrand and Burkert (2) point out that "the increase in stickiness and in dough mobility noted with excessive treatment of malted wheat flour cannot be ascribed to proteolytic activity of such flours, but is due rather to excessive alpha-amylase activity."

Unmalted flour was treated with cereal malts and fungal enzymes at the level of 3,100 SKB units per 100 lb. of flour. This level with the cereal malt produces an amylograph reading of 480 B.u. The fungal alpha-amylase has no effect on the amylo-



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graph reading. Gassing power results are shown in the table below. This was determined by the collection of gas produced by 175 g. of sponge at atmospheric pressure. At 3 hours, no differences were detected. At five hours some differences were noted.

	Gas Produced in 5 Hours from 175 g. of Sponge ml
Unmalted flour	1,130
Plus wheat malt	1,565
Plus barley malt	1,595
Plus fungal: low protease	1,400
Plus fungal: high protease	1,415

This small difference in gassing power between the cereal and fungal malts did not affect the baking results.

It is extremely difficult to measure loaf fragility scientifically. Bakes were made with unmalted flour, unmalted flour plus cereal malt, and unmalted flour plus fungal enzymes. The supplementations were

at the level of 3,100 SKB units per cwt. The loaves were cooled 1 hour and permitted to slide down an incline. The loaves made from unmalted flour showed the least fragility, the loaves made with cereal malt showed a serious fragility, and the loaves containing fungal enzymes showed slightly more fragility than the bread made from unmalted flour, but were far less fragile than the loaves containing cereal malt.

Malt supplementation has a definite effect on shelf-life of the loaf since it affects the squeeze test. The higher the malt, the softer the loaf by the squeeze test. Fungal enzymes will produce this softness effect to a degree similar to that of cereal malt.

#### Summary

Under commercial conditions flour with little or no cereal malt supplementation, and with fungal enzymes added by the baker, will produce all of the advantages of

cereal alpha-amylase without its adverse effects on crumb gumminess and loaf fragility.

In addition, fungal enzymes provide the baker with protease supplementation with which he can control his mixing times as the character of the flour changes from crop to crop.

Softness measurements have shown that fungal enzyme supplementation produces keeping properties similar to that produced by cereal malt supplementation.

#### Acknowledgment

The author expresses his appreciation to the Wallerstein Company for their kindness in carrying out the measurements of alpha-amylase and protease activity as measured by SKB and hemoglobin units.

#### Literature Cited

1. GEDDES, W. F. J. *Agr. Food Chem.* 7: 605 (1959).
2. HILDEBRAND, F. C., and BURKERT, G. M. *Cereal Chem.* 19: 27 (1942).
3. JOHNSON, J. A., and MILLER, B. S. *Cereal Chem.* 25: 178 (1948).
4. PROUTY, WILLIAM. *Baker's Digest* 34: 54 (1959).

## IMPORTANT NOTICE—46th ANNUAL MEETING

Members of the AACC wishing to present papers at the 46th Annual Meeting, April 9-13, 1961, in Dallas, should write immediately to the chairman of the session covering their field of interest.

The following sessions have been scheduled: *Pesticide Residues in Cereal Products*, Warren O. Edmonds, American Cyanamid Co., 3125 Gillham Plaza, Kansas City 9, Missouri; *Flavor Research*, Lazare Wiseblatt, American Institute of Baking, 400 E. Ontario St., Chicago 11, Illinois; *Feed Technology Session No. 1*, Robert C. Wornick, Chas. Pfizer and Co., Inc., Ag Research Dept., Terre Haute, Indiana; *Chemistry and Technology of Yeast*, Gerald Reed, Red Star Yeast and Products Co., 325 N. 27th St., Milwaukee, Wisconsin; *Feed Technology Session No. 2*, Max L. Cooley, Hoffman-Taff, Inc., Box 1246 S.S. Station, Springfield, Missouri; *Continuous Breadmaking*, Oscar Skovholt, Quality Bakers of America, 120

W. 42nd St., New York 36, New York; *Starch Chemistry*, R. M. Sandstedt, Dept. Biochemistry and Nutrition, U. of Nebraska, Lincoln 3, Nebraska; *General Session*, Frank R. Schwain, Bulk Food Technical Services, Procter and Gamble Co., Winton Hill Tech. Center, Box 201, Cincinnati 24, Ohio; *Chemistry and Technology of Flour*, Kenneth Gilles, General Mills, Inc., 2010 E. Hennepin Ave., Minneapolis 13, Minnesota; *Useful Laboratory Techniques and Gadgets*, Lawrence L. Warren, Commander Larabee Milling Co., P.O. Box 356, Kansas City 41, Missouri; *Laboratory Layouts*, Grant W. Percy, The Pillsbury Company, 224 Second St., S.E., Minneapolis 14, Minnesota.

BYRON S. MILLER,

Program Chairman, Kansas State University, Manhattan, Kansas.  
(Department of Flour and Feed Milling Industries)

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## STUDIES

## LEADING TO PRODUCTION OF

# Bread Aromatics from Browning Systems<sup>1</sup>

By P. J. Kiely, A. C. Nowlin, and J. H. Moriarty, Food and Flavor Department, Arthur D. Little, Inc., Cambridge 40, Massachusetts

THE GENERAL CEREAL field, like many others, is experiencing the results of recent and startling technological advances. In food manufacture, these innovations often bring about flavor changes that inadvertently reduce flavor acceptability.

A product that falls into this category is the chemically leavened Instant Bread Mix developed by the Quartermaster Corps. Since yeast as a bread ingredient is difficult to store and use, in the QM Instant Bread formula it has been replaced with a chemical leavening system based on the thermal leavening properties of the delta-lactone of gluconic acid, as described by Miller *et al.* (4). While the bread so produced is comparable to yeast-leavened bread in volume and texture, it is bland in taste, lacking the odor and flavor of yeast-raised bread.

The problem, of course, was to find a means of producing the flavor characteristics of yeast-leavened bread. It has long been known that the browning or Maillard reaction, a reaction between amino acids and particular sugars, contributes to the color in the crust of bread. This very complex reaction also produces flavor and odor changes, in some cases desirable, in others quite undesirable. Baker *et al.* (1) reported that the crusty flavor of the bread crust is carried into the crumb in

the form of volatile aldehydes which are produced by the reduction of the amino acids by browning. These, it was reported, are rapidly drawn into the interior of the loaf on its removal from the oven as the steam and alcohol of the crumb condense and create a negative pressure in the middle of the loaf. Further, Barnes and Kaufman (2), in their work on maple flavor, observed that the use of an amino acid, leucine, with a single carbohydrate, could produce odor and flavor characteristics of fresh bread.

In an effort to impart the aromatics of yeast-leavened bread into the Instant Bread, a laboratory program to investigate the browning reaction as a source of fresh bread aroma was initiated in the Food and Flavor Department of Arthur D. Little, Inc., in cooperation with the Quartermaster Food and Container Institute for the Armed Forces. Since flavor includes the four basic tastes, as well as feeling sensations plus any aromatics that are forced through the back passages of the nose, the development of a source of fresh bread aromatics would lead ultimately to flavor contributions.

### Amino Acid-Sugar Reactions Studied

A study was begun of the aromas resulting from the condensation products of reactions between twenty amino acids and eight sugars, with the aim of determining which combinations of amino acids and sugars would give breadlike aromatics. The amino acids used were glycine, alanine, leucine, isoleucine, proline, threonine, cystine, arginine, histidine, cysteine hydro-

chloride, methionine, tryptophan, aspartic acid, glutamic acid, lysine hydrochloride, valine, phenylalanine, tyrosine, hydroxyproline and serine. The sugars selected were glucose, fructose, maltose, sucrose, arabinose, ribose, xylose, and rhamnose.

These reactions were carried out at three aqueous levels—15, 25, and 50 parts aqueous. The lower level has been considered the optimum for naturally occurring browning reactions and it also approximates the lower limit of moisture in baked bread. The 50-parts level was chosen arbitrarily. The intention was to simulate the 60% moisture level found in typical bread dough; but with no flour present to take up the excess water, we found that approximately 50% moisture was adequate to permit good wetting and mixing with even the less dense and more insoluble amino acids.

Four pH levels were used in these experiments—4.0, 5.0, and 6.0 to simulate actual bread-dough pH ranges, and 8.0 to approximate the alkaline medium considered most favorable to rapid browning reaction.

Three different temperatures were involved: 50°, 100°, and 150°C. For the 150° temperature experiment, 16 × 150 mm. culture test tubes with screw caps, partially vented were utilized. For the lower temperatures, test tubes 18 × 150 mm., with aluminum-foil-wrapped cork stoppers were found to be satisfactory. Room temperature was tried initially to simulate dough-proofing conditions, but since no aroma change was apparent in 7

<sup>1</sup>Presented at the 45th annual meeting, Chicago, Illinois, May 1960. This paper reports research undertaken in cooperation with the Quartermaster Food and Container Institute for the Armed Forces, QM Research and Engineering Command, U. S. Army, and has been assigned number 2028 in the series of papers approved for publication. The views or conclusions contained in this report are those of the authors. They are not to be construed as necessarily reflecting the views or endorsement of the Department of Defense.

days at this temperature, this step was eliminated.

A 1:1 molar ratio of sugar to amino acids was used. Where the amino acid contained more than one amino group a 2:1 molar ratio was also used, but little or no difference in aroma was observed.

### Methodology

The amino acid and sugar were placed in the test tubes and the pH adjusted to the desired point by the use of McIlvane's Standard Buffer Solutions. These buffer solutions were also the source of the aqueous medium. The test tubes were partially immersed in water or oil baths held at the specific temperatures.

In establishing methodology, it was found that the character of reaction aroma could best be ascertained when the mixture had reached a medium or "golden" brown color, and thus reaction color served to designate the endpoint. Because of the susceptibility of the character of the aromas to change on cooling, it was found necessary to examine the tubes immediately upon their removal from the bath.

The aromatics from these reactions were examined by trained and experienced panel members, utilizing the techniques of the Flavor Profile method of flavor and odor analysis (Cairncross and Sjöström, 3). In carrying out these analyses, the total intensity of the emanating aromatics was determined and the principal character notes were described. Reaction time and other observations of interest were also noted.

As the laboratory program progressed and data accumulated, various modifications were made in the approach. As expected, the rate of reaction proceeded fastest at pH 8, with the exception of arginine, histidine, and lysine, which reacted fastest at pH 4. However, as the experimental approach became more specific the work was directed toward conditions existing in the preparation and baking of bread, and thus two pH levels, pH 4 and pH 6, were emphasized. Similarly, the 50°C. temperature experiments were later abandoned, since a reaction time of 24 to 48 hours was

frequently necessary to produce any bread characteristics, and because 100° and 150°C. more closely simulated actual bread-baking conditions. One negative factor associated with the higher reaction temperature was that, in general, any harsh, unpleasant, or choking notes that might be present at 50° or 100° were greatly intensified at 150°C.

In most cases, approximately 15% moisture content resulted in the most rapid reaction rate, but more important to the reaction time was the adequate wetting of the amino acid and sugar. Thus, when the materials were light and "fluffy," more liquid was required to wet them thoroughly.

Although a very careful comparison was made of the eight sugars in the reactions, significant differences in the production of bread aromatics between the sugars was not apparent; there were some differences, however, in the rates of reaction.

### Flavors and Aromas Identified

In flavor profile examinations of freshly baked bread it was found that character notes such as yeasty, fruity, grainy, butyl and ethyl alcohols, sweet, toasted, and buttery were present. Such typical breadlike aromatics, although they were not all of the same character, were produced consistently by leucine, histidine, and arginine. Certain specific reactions of some other amino acids produced some breadlike characteristics, but these were not produced consistently and were usually accompanied by inappropriate notes such as heavy burnt, aminelike, resinous, and green sour, that would tend to negate the results.

Although we were primarily interested in browning reactions that produced breadlike aromatic condensation products, other aromas were noted that might be of interest in other circumstances. For example, phenylalanine produced a floral, rose-perfume aroma; proline, cornlike; hydroxyproline, potato; cystine and cysteine hydrochloride, meaty; cystine also produced burnt turkey skin aromatics; valine and isoleucine produced

fruity aromatic characteristics; glycine, caramel. These experiments also demonstrated that the aromatics produced may be described as typical for the amino acid used. To a great extent, therefore, the desired aromatics could be predicted by selection of the suitable amino acid. Although these findings were incidental to the main purpose of the project, they are nevertheless interesting and warrant further study.

To establish a base line for determining the effects of incorporating browning systems into the Instant Bread Mix, the flavor and aroma of the unflavored loaves were characterized. The aroma consisted mainly of raw-starchy-doughy, grainy, sweet characters. The flavor by mouth was found to be predominantly grainy, starchy, raw-dough, sweet. In addition, the baking soda in the leavening system was apparent. Astringency was also noted.

Since dextrose was already present in the Instant Bread Mix it was only necessary to add the amino acids to the dry ingredients before the mixing step. Leucine, at a 0.05 to 0.1% level based on the weight of mix, produced a toasted, breadlike aroma and flavor; both arginine and histidine added an appropriate buttery note. All three contributed by partially or completely eliminating the raw-starchy-doughy note found in both the aroma and flavor of the control loaf. The combination of leucine with either arginine or histidine produced appropriate aroma and flavor notes.

This program, undertaken to study bread aroma and flavor development, has also indicated an area of high potential where browning reactions may be used to develop specific flavor or suppress unwanted flavor characteristics.

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HOW NEW FOOD  
LAWS AFFECT

# Baking Technology and Nutritional Trends in Germany<sup>1</sup>

By Anita Menger, Federal Grain Research Institute, Detmold, Germany

THESE PROBLEMS MAY seem rather remote from what cereal chemists in the United States are used to dealing with in an economical and technological situation quite different from that in Germany.

Whereas most of the bread in the U. S. is manufactured in large commercial bakeries, in Germany, according to 1957 statistics, 92% of all bakeries are small to medium in size, employing two to nine persons. These bakeries turn out approximately 85% of the total production of baked goods. Larger plants, employing 10 to 49 persons, total only about 4% of all bakeries and 10% of production, not including pastries. And whereas white bread by far dominates the American market, we depend largely on so-called mixed breads, prepared of comparatively darker rye and wheat flours in various ratios. Such breads account for about 60% of German bread consumption, white bread and rolls for only 15 to 20%, and whole-grain loaves for another 15%. These few figures should help to explain why, in German baking technology, the emphasis often rests with problems which in the United States, if they exist here at all, would be of only minor importance.

We do have at least one recent experience in common, namely, the revision of existing food laws within the past four years—undertaken in both countries with the objectives of protecting public health from the indiscriminate use of food additives and of establishing appropriate safety requirements.

## The German Flour-Bill of December 1956 and Its Consequences

In Germany, the first step towards this goal was undertaken with the passage of the so-called "Flour-Bill" on December 27, 1956. This bill prohibited the use of all bleaching agents, oxidizing flour improvers, rope and mold inhibitors, and artificial colorings in connection with cereal grains, milling products, baked goods, and alimentary pastes, with the following exceptions: ascorbic acid as a flour improver; acid sodium acetate, calcium acetate, and calcium propionate to prevent rope and molds, respectively; and "natural" color pigments such as carotene, riboflavin, or carminic acid, for coloring baked goods. These prohibitions became effective in April 1957. Although the use of potassium bromate was further permitted until the end of 1957, its maximal addition was limited to 40 p.p.m. of flour.

The issuance of the Flour-Bill was preceded by several years of elaborate investigations and public hearings on the potential danger of this group of chemical additives to human health, detrimental effects on the nutritional value of cereal foods, and the technological necessities for their eventual continued use. Quite naturally, our laboratories became extensively engaged in these preliminary studies.

## Bleaching Agents and Flour Improvers

Since the destruction of flour vitamins through bleaching and oxidizing agents was a point on which attacks were concentrated, we designed experiments to fur-

nish the details necessary for an unemotional discussion of the facts. As was expected, our results confirmed that flour treatment with nitrogen trichloride, chlorine dioxide, or benzoyl peroxide leads to a considerable loss of tocopherols, along with the intended destruction of yellow flour pigments, because this kind of treatment affects the lipid fraction in which both groups of compounds are contained. However, we did not observe a significant influence of bleaching of the inherent thiamine in wheat flour, nor did bleaching impair the stability of added synthetic thiamine, riboflavin, and niacin during storage or in the baking process.

Non-bleaching flour improvers such as potassium bromate and ascorbic acid had no detrimental effect at all on the tocopherols during storage or baking, conceivably because these hydrophilic substances do not enter the lipid phase. Ascorbic acid, of course, could exert an oxidizing effect only after its conversion into dehydroascorbic acid in the dough. Neither was there any measurable action of the tested flour improvers on thiamine. These results obliterated one of the most widely used arguments against potassium bromate, and were later confirmed by independent studies of Arne Schulerud in Norway. But, since it was still maintained by extremists that residues of bromate or bromide might have as yet unknown side-effects on human metabolism, possibly by means of undesirable actions on enzyme systems, the legislature, nevertheless, finally decid-

<sup>1</sup>Presented at the 45th annual meeting, Chicago, Illinois, May 1960.

ed against potassium bromate.

The interesting thing about this development is that, contrary to gloomy prophecies, the quality of German rolls and white bread did not show a sharp decline the day the bromate ban went into effect; and this can be ascribed only in part to the employment of ascorbic acid. More careful blending of wheat qualities, heat-conditioning of weak inland wheats, taking advantage of the natural aging process of flour through aeration and prolonged storage, intelligent application of the still permissible baking aids containing malt and lecithin, and skillful handling in the individual bakeries obviously made up for the absence of potassium bromate to an unexpected degree. There is no doubt that bread factories suffered most from the increased variability in flour quality, since they are not as flexible as small bakeries in adjusting their procedures. But even they managed to solve the problem somehow. At any rate, it appears that the technical inconveniences imposed on the milling and baking trade, and perhaps a slight drop in product quality apparent to the consumer, were not insurmountable obstacles to the successful execution of this part of the new law. It certainly helped, though, that we had not been accustomed to bread of such high volume as yours in the United States, and that rolls and white bread, although a rather profitable part of the total production, do not form a major part of it.

#### Ascorbic Acid as a Flour Improver

That ascorbic acid has an improver effect similar to that of potassium bromate was first discovered by H. Jørgensen, who reported it as early as 1935. The underlying chemical reactions were further studied by Melville and Shattock in New Zealand and later on were very intensively investigated by P. Maltha in The Netherlands. For the obvious paradox, that a reducing agent like ascorbic acid is able to act as an oxidizing flour improver, these authors found a logical explanation in the fact that ascorbic acid is reversibly oxidized to dehydro-ascorbic acid to a greater or lesser extent during dough-making, and that it is ac-

tually this latter substance which accounts for the observed beneficial influences on bread quality.

Because of its high price and supposedly less reliable action ascorbic acid was hardly given a try by German millers and bakers as long as potassium bromate was permissible. In France and Switzerland, where a bromate ban already existed, a baking aid containing ascorbic acid was being advertised, but no data about practical experience with it could be obtained. For a statement on the feasibility of ascorbic acid additions to German wheat flours we had therefore to rely on our own experiments. We found, in short:

1. When added to flour, ascorbic acid proved to be sufficiently stable under normal German storage conditions—i.e., temperatures around 20°C. and maximally 15% moisture in the flour—for the usually required period, one year or less.

2. Under adverse conditions the danger of irreversible activity losses increased with increasing temperatures and moisture contents, and we were able to prove that these losses are due to a Mailard-type reaction between ascorbic acid—which takes, in this case, the place of reducing sugars—and flour protein or protein degradation products. As a diluting agent for ascorbic acid-containing baking aids we recommended starch instead of flour.

3. Since it made no difference for the over-all improving effect whether the ascorbic acid was incorporated into the flour in the dry state or added to the dough in aqueous solution, the latter should be preferred in extreme climates, to avoid possible storage losses.

4. The effect on dough stability and bread volume was largest (10-20%) with freshly milled flours and declined gradually as the natural aging process proceeded.

5. Just as with potassium bromate, flours required higher additions of ascorbic acid with increasing ash content and decreasing amounts with increasing age. In combination with malt flour the optimal effect could be achieved with markedly reduced concentrations of ascorbic acid, especially in the lower extraction range.

Surveys on the treatment of German bakery flours, which have been conducted by several agencies during the past two years, differ widely in their results. It is established that, depending on the extraction rate, between 20 and 40% of these flours are treated with ascorbic acid in the mills. However, we have no reliable figures to indicate to what extent the bakers themselves incorporate ascorbic acid in baking aids, and therefore we cannot estimate how important a role this improver actually plays at the present time.

#### Rope and Mold Inhibitors

The fact that only acid sodium acetate, calcium acetate, and calcium propionate are still permitted as rope or mold inhibitors makes it imperative to have rapid, sensitive, and reliable methods to detect abuses. Suitable analytical procedures had therefore been worked out by our chemist E. Drews years before. His technique, based on filter-disk paper chromatography, is now widely used in public food control laboratories for the detection of prohibited preservatives in bread and baked goods.

An interesting finding emerged as a by-product of these analytical studies, which may well become of some practical importance in the manufacture of whole-meal breads. It was observed during these tests that whole-meal breads and pumpernickel, both made of rye, contained unusually large amounts of formic acid which further increased with the length of baking time or a rise in oven temperature. Since the same factors intensified the browning of crust and crumb, and a striking parallel between formic acid content and crumb color was not to be overlooked, an interrelation between nonenzymatic browning and formic acid formation was suggested. The literature revealed that several authors had indicated ways in which formic acid might be split off from hydroxymethylfurfural in an acid medium during introductory stages of melanoidin reactions. If transformations of this nature were going on in whole-meal bread, the addition of reducing sugars and amino-compounds to the dough should lead to an increased production of formic acid. This was found to be true.

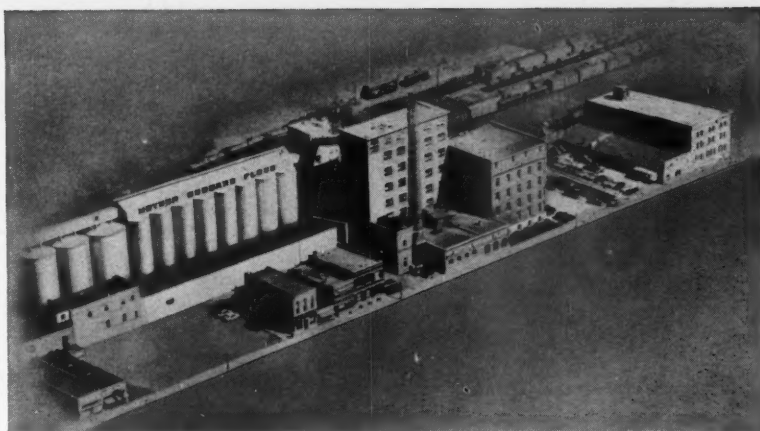
Formic acid and its salts are rather effective preservatives and, since there is a strong trend in Germany to follow "natural" ways of food processing whenever feasible, it seemed worth while to determine whether this kind of natural formic acid formation could be enhanced to a degree where it offered commercially useful mold protection. Proper manipulation of the formulas brought encouraging results, especially with the incorporation of 3% soybean flour, 3% skim milk powder, or 5% malt flour. In comparison with the controls, the shelf-life of these test loaves was prolonged two- to four-fold in mold resistance.

#### Amendment of the German Food Law of December 1958

Thus far I have tried to exemplify how the Flour-Bill, as a forerunner to a pure food law, forced the German milling and baking trade into a completely new approach to many of its technological problems. Now I should like to conclude with some remarks concerning the principles of an amendment to the German food law passed on December 21, 1958. In its most important parts, it became effective after a one-year transition period, during which time a series of eleven regulations was prepared to specify the details according to the general outline given in the law. They were passed on December 19, 1959, just before the deadline.

The main change in the legal situation is this: whereas formerly everything that was not specifically prohibited was permissible, from now on all food additives and processing methods which are not specially approved by the law are forbidden. In the future, the inventor of anything new in food processing will have to furnish sufficient evidence that it is safe for human health before he can hope to obtain an exemption. Of the eleven regulations, however, not more than three are bearing directly on the production of baked goods: the general regulation on food additives, and those on the coloring of foods and the use of preservatives. And since most of the "pure-food rules" in this section had previously been set by the

(Please turn to page 296)



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## AACC PESTICIDE RESIDUES COMMITTEE REPORT: 1960

HARLAN L. PEASE, E. I. du Pont de Nemours &amp; Co., Wilmington, Delaware

EDITOR'S NOTE: The following method was submitted to the Pesticide Residues Committee as a contribution from the Industrial Biochemicals Department, Experimental Station, of E. I. du Pont de Nemours & Co. It is published with permission of the Du Pont Company.

Several methods for detecting small amounts of methoxychlor have been published (1,2,6,7); however, because of its greater selectivity and high sensitivity, the Fairing-Warrington (3) method appears most suitable.

The Fairing-Warrington method for determining traces of methoxychlor involves the quantitative dehydrohalogenation of methoxychlor with alcoholic potassium hydroxide and reaction of the dehydrohalogenated product with 85% sulfuric acid to produce a red complex with an absorption maximum at 550  $m\mu$ . This method is sensitive to 2  $\gamma$  of methoxychlor. Many other pesticidal chemicals such as DDT, lindane, and toxaphene do not respond. Waxes and oils do interfere, however, because of the charring action of sulfuric acid on such substances, and these must be separated from the methoxychlor residue. Using the series of simple clean-up techniques described in this paper, it is possible to reduce the blanks obtained on untreated samples to 0.1 p.p.m. of apparent methoxychlor.

Residues of methoxychlor are removed from the crop by a suitable extraction procedure. The solvent extracts are treated with Darco to eliminate interfering color, and the methoxychlor is further purified by solvent-partitioning techniques. Once isolated from most of the interfering materials, the methoxychlor is dehydrohalogenated in alcoholic potassium hydroxide. This derivative is separated from the reaction medium by solvent extraction and passed through a chromatographic column to remove the final traces of waxes and oils. After separation from all interfering substances, the dehydrochlorinated methoxychlor is reacted with sulfuric acid to produce a red complex having an absorption maximum at 550  $m\mu$ . The intensity of the colored product formed is dependent upon the concentration of the sulfuric acid color reagent. The optimum acid concentration is about 82.5%, with the color intensity falling off rapidly at lower concentrations. Acid of 85% is desirable, so that the sensitivity of the reaction is not decreased by the absorption of small amounts of moisture from the air. The rate of color development will vary; 1.5 hours, however, has been found satisfactory for all samples. Addition of a small amount of ferric chloride to the acid assures complete color development.

**A LOW-BLANK METHOD FOR THE DETERMINATION OF METHOXYCHLOR RESIDUES IN FOODS**

**Reagents:** (1) Standard Methoxychlor Solution, para-para isomer, m.p. 87°–88°C. Recrystallize technical grade methoxychlor two to three times from 95% ethyl alcohol. Prepare a standard solution containing 5  $\gamma$  per ml. methoxychlor by dissolving 0.0625 g. of the purified material in 250 ml. of reagent grade benzene and diluting 5 ml. of this solution to 250 ml. with reagent grade benzene.

(2) Benzene, reagent grade.

(3) Petroleum ether, C.P., boiling range 35°–60°C.; purified by elution through a column of chromatographic alumina. (Aluminum oxide, reagent grade, suitable for chromatographic adsorption.)

(4) N-hexane, commercial grade, redistilled.

(5) Nitromethane, technical grade, redistilled.

(6) Dehydrohalogenation reagent, 4% (w/v) of reagent grade potassium hydroxide in 95% ethanol, freshly prepared before use.

(7) Colorimetric reagent, 85% sulfuric acid (82.5–88.0% is acceptable), containing 10 mg. ferric chloride per liter. Because it is difficult to prepare and maintain sulfuric acid of an exact concentration, it is advisable to prepare a standard curve for each new batch of color reagent. It is also advisable to run a standard of known methoxychlor concentration along with each set of samples being analyzed in order to correct for changes in the acid strength.

(8) "Darco", activated carbon: Darco Corporation, New York. **Apparatus:** (1) Erlenmeyer flask, 250-ml. capacity; standard taper 24/40.

(2) Condenser, 20-cm. length; standard taper 24/40.

(3) Chromatographic column, 1 to 1 weight ratio of Celite No. 545 and heavy, adsorptive magnesia, USP grade. Slurry-mix the composition in redistilled hexane; dry, using a current of oil-free and drypack to a depth of 60 mm. in an all-glass, coarse fritted-disk Allihn filter tube (100 mm. by 20 mm). Fisher Scientific Company, Pittsburgh, Pa.

(4) Spectrophotometer, Beckman Model B or equivalent.

(5) Centrifuge, International, Size 1, Model BE 50, or equivalent, equipped with 250-ml.-capacity centrifuge bottles.

**Separation of Methoxychlor**

**Grain and Milled Products:** Transfer a 50-g. sample to a 250-ml. glass-stoppered Erlenmeyer flask, add 100 ml. of benzene, and shake vigorously for 2 to 3 minutes. Allow the mixture to settle, then carefully decant the solvent through Whatman No. 40 filter paper into a 250-ml. beaker. Repeat the extraction two more times, each time using 50 ml. of benzene, and combine the solvent extracts with those previously collected. Concentrate the combined benzene extracts to about 40–50 ml. at room temperature, using a slow stream of oil-free air to hasten evaporation.

**Fruit and Vegetables:** Weigh a 100- to 500-g. sample, dependent upon the bulk and the density of the food crop, into an Erlenmeyer flask of suitable size, or a screw-cap glass jar. Add sufficient benzene, 200–300 ml., to thoroughly wet the surface of the crop and shake vigorously for 2–3 minutes. Allow to settle and carefully decant the solvent through Whatman No. 40 filter paper into an 800-ml. beaker. Repeat the extraction two more times, each time using the required amount of benzene (100–200 ml.) to ensure complete washing of the sample. Combine the solvent extracts in the 800-ml. beaker and concentrate at room temperature to 40–50 ml., using a slow stream of oil-free air to hasten evaporation. When the methoxychlor residue is expected to be greater than 1 p.p.m., transfer the concentrated extract quantitatively to a 50-ml. volumetric flask, using small portions of benzene as wash. Dilute to the mark with benzene and mix thoroughly. Select an aliquot of appropriate size and dilute the volume to about 50 ml.

**Materials:** Weigh a 50-g. sample into a Waring Blendor, add 100 ml. of N-hexane, and blend for 2-3 minutes. Transfer quantitatively to a 250-ml. centrifuge bottle, centrifuge for 15-20 minutes at 2,000 r.p.m. and carefully decant the solvent extract into a 400-ml. beaker. Add 100 ml. of fresh hexane to the centrifuge bottle, stopper with a polyethylene plug, and shake thoroughly for 2 minutes. Centrifuge as before, combining the solvent with that in the 400-ml. beaker. Repeat the extraction with an additional 100-ml. portion of hexane, combining the solvent extract with those previously collected. Concentrate the combined hexane extracts to about 40-50 ml. at room temperature, using a slow stream of oil-free air to hasten evaporation.

**General Procedure:** Add 1 g. of Darco to the concentrated extracts and place in a 60°-70°C. water bath for about 10 minutes. Filter through Whatman No. 40 filter paper, wash with three successive 5-ml. portions of benzene, and collect the solvent in a 100-ml. beaker. Carefully evaporate the solvent to dryness at room temperature.

Dissolve the residue in 15 ml. of redistilled hexane and transfer quantitatively to a 60-ml. separatory funnel, using three successive 5-ml. portions of hexane as wash. Add 10 ml. of redistilled nitromethane to the separatory funnel and shake the contents vigorously for at least 2 minutes. When the layers have separated, drain the lower (nitromethane) layer into a 125-ml. separatory funnel containing 10 ml. of redistilled hexane. Extract the original hexane three additional times, using 10 ml. of nitromethane each time, and collect the nitromethane layer into the 125-ml. separatory funnel. Shake the combined nitromethane extracts with the 10 ml. of hexane to remove traces of interfering substance which have partitioned into the nitromethane. After the phase separation, drain the nitromethane layer into a 250-ml. Erlenmeyer flask. Carefully remove the solvent on a steam bath, using a slow stream of oil-free air. Solvent evaporation should be taken just to dryness to avoid losses of methoxychlor.

Add 50 ml. of the 4% alcoholic potassium hydroxide solution, attach the flask to a water-cooled condenser, and reflux the contents gently for 30 minutes. Cool the flask, rinse the condenser with 50 ml. of distilled water, and transfer the entire content of the flask to a 50-ml. separatory funnel with the aid of 100 ml. of petroleum ether.

Shake thoroughly and allow the layers to separate. Drain the lower, aqueous phase, into a 250-ml. separatory funnel and repeat the extraction with 25 ml. of petroleum ether. Drain the aqueous phase to discard and combine the petroleum ether extracts in the 250-ml. separatory funnel. Backwash the combined extracts with 20 ml. of an equal-volume mixture of 95% ethanol and distilled water. Transfer the washed extract to a 100-ml. beaker and carefully evaporate to dryness at room temperature, using a slow current of oil-free air to hasten evaporation. Redissolve the residue in 50 ml. of redistilled hexane and pass through a Celite-magnesia column by gravity flow. After the final incremental addition, wash the column with an additional 25 ml. of hexane and combine with the original effluent in a 100-ml. beaker. Evaporate the hexane solution to dryness at room temperature, using a current of oil-free air. Add 20 ml. of the sulfuric acid color reagent to the residue and allow the mixture to stand, with occasional swirling, for 1.5 hours.

Determine the absorbance of the resultant pink solution on a suitable spectrophotometer, at 550  $m\mu$ , using the sulfuric acid reagent as the reference solution. If the colored product formed is of deeper intensity than expected and therefore beyond the range of the standard curve, it may be diluted with additional 85% sulfuric acid. Add 1.0 ml. of ethyl ether for each 10 ml. of diluting acid. The results obtained by this procedure are usually satisfactory, though less precise than when the dilution is not necessary.

Determine the amount of methoxychlor in the sample from a calibration curve prepared from known amounts of pure methoxychlor which have been subjected to the dehydrochlorination and color development steps described above.

## Results

Using this procedure, blanks of less than 0.1 p.p.m.

are encountered with a wide variety of foods, and high recoveries of methoxychlor residues are obtained. Table I shows the blanks obtained on a few typical materials, and recoveries of known amounts of methoxychlor added to these foods are summarized in Table II. To obtain these results it is essential that all

Table I. Apparent Methoxychlor Level on Untreated Foods

Crop	Average Blank, Apparent p.p.m. Methoxychlor	No. of Determinations	Average Deviation, Apparent p.p.m. Methoxychlor
Corn grain	0.03	11	0.008
Rice	0.06	8	0.018
Flour	0.07	12	0.014
Snap beans (green)	0.08	5	0.008
Cucumber	0.02	3	0.003
Peanuts	0.04	9	0.014

Table II. Recovery of Known Amounts of Methoxychlor Added to Untreated Foods

Crop	Residue Level p.p.m.	No. of Determinations	Percent Recovery <sup>a</sup>		
			Range	Average	Deviation
Corn grain	0.08-1.16	14	87.5-105.0	94.6	4.3
Rice	0.08-1.25	13	90.5-112.5	101.2	5.5
Flour	0.08-6.0	16	90.0-108.8	97.3	5.5
Snap beans (green)	0.63-11.0	13	88.5-99.1	92.6	3.1
Cucumbers	0.23-2.9	10	89.0-96.6	92.0	2.3
Peanuts	0.10-2.0	11	89.1-108.0	96.3	4.1

<sup>a</sup> Corrected for blanks.

steps described under *General Procedure* are strictly adhered to. Minute quantities of waxes and oils are conducive to high blanks and low recoveries, because of the charring action of sulfuric acid on such substances, and it is therefore important that they are completely removed before the colored complex is formed. The Darco treatment is necessary for removal of colored extractable materials in the original solvent strip solution; the solvent partitioning step is necessary for separating the bulk of the interfering matter from the methoxychlor prior to its dehydrochlorination; and the column chromatographic step is necessary for removal of final traces of waxes and oils. The inclusion of all steps results in a very sensitive and precise procedure for determining residue of methoxychlor on a wide variety of foods.

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# AACC LOCAL SECTIONS

**Southern California Section** held the first meeting of the new season on Tuesday, Sept. 13, at Rodger Young Auditorium in Los Angeles. Roy Sampson of The Pillsbury Co., Los Angeles, spoke on "Modifications of the oxygen bomb procedure, for determination of stability in edible fats and oils." He reported that the construction of an especially built apparatus has enabled the laboratory to complete stability tests in 2½ hours, thus speeding up production in a mix plant. The new testing procedure agrees with standard tests, he said.

A local constitution was adopted at this meeting. A deep-sea fishing trip was suggested, and arrangements are being looked into.

At the October 4 meeting, Joe DeHaan of General Mills and Joe Topps of California Mills, Los Angeles, gave talks on the new-crop wheats and the new-variety wheats available; then, with representatives of other local flour mills, a round-table discussion was held, with a question-and-answer period.

**Northwest Section** met on September 30 at Jax Cafe in Minneapolis. Guest speaker was AACC National President John A. Johnson, who discussed bread flavor and the complexities involved in determining reasons for palatability. He said that isolation and identification of the compounds involved is necessary to proceed efficiently; 30 to 50 compounds are suspected as being involved. Besides the organic acids and alcohols, carbonyls are being extensively investigated; identifications are being made with paper and gas chromatography. Progress is rapid, Dr. Johnson reported.

New members: Myrland Dahl, Atkinson Milling Co.; Norton Risdal, Russell-Miller-King Midas Mills; W. T. Yamazaki, International Milling Co.

**Niagara Frontier Section** members enjoyed a conducted tour of the Retsof Salt Mine of the International Salt Co., southeast of Batavia, N. Y., on September 24.

October 22 is the date of a joint all-day meeting with Toronto Section and Niagara Section AOM, at the Lenox Hotel, Buffalo.

**Midwest Section's** program committee met during the summer and arranged a well-rounded series of programs, including three symposia composed of short talks relating to new developments in cereal fields by those who are "in the know," beginning with "What's new in products from corn" in January. On October 3, Professor C. T. Greenwood, Lecturer in Chemistry at the University of Edinburgh, spoke on "The molecular properties of the components of starch." Prof. Greenwood is one of the foremost contemporary research workers in starch chemistry; he has brought into the field many fresh viewpoints and techniques that have upset some widely held ideas on starch structure. In his research he has been particularly interested in the molecular size and shape of the starch components.

The November 7 meeting schedules AACC President John A. Johnson as guest, speaking on the subject "Browning reactions in bread."

**Cincinnati Section's** 17th annual convention, with Ohio Valley District AOM, was held on October 7 and 8 in Indianapolis. A highlight was a plant tour of The Kroger Co.'s all-new bakery, featuring five separate automated production lines. Surveying 20 years of sanitation, George Wagner, The Pillsbury Co., Minneapolis, discussed "Progressive sanitation in the milling industry," including problems presented to millers and chemists by the Miller Bill and the Delaney Amendment. "Protein and its effect on cookie spread" by Ray Mooi, Hekman Biscuit Co., Grand Rapids, Mich., dealt with cookies baked with white and red wheat flour, and placed particular emphasis on volume and cookie spread and their variation according to the percent of protein present. "Program for modernization of milling equipment in the new decade" was presented by George Tesarek, manager of Quaker Oats Co.'s flour mill at St. Joseph, Mo.

The annual analysis of the new wheat crop was given by Howard Simmons, Midwest Laboratories, Columbus, Ohio.

New members: Norman Howard, Procter & Gamble Co., Cincinnati; E. J. Hueckel, Keever Starch Co., Columbus, Ohio; Eugene Ussery, Birdsey Flour & Feed Mills, Macon, Ga.

**New York Section** met at The Brass Rail on September 13 to open the new season. Four past-presidents of the AACC were present: Betty Sullivan, Clint Brooke, Oscar Skovholt, and D. B. Pratt, Jr. Guest speaker was Andres Ferrari, director of research laboratories of Technicon Instruments Corp. In his talk, "Automated chemical analysis," he described the use of the AutoAnalyzer in the practical automation of chemical analysis and its application to the food industry. This is a fairly recent development in instrumentation which permits automatic and continuous quantitative chemical analysis and determination of protein, chlorides, sugars, etc., in any medium. Mr. Ferrari specifically described the automation of the Kjeldahl procedure for determination of nitrogen or protein content. Slides and color films were shown of the actual equipment in operation.

New members: David Baker, Anheuser-Busch; Miss Beate Feller, Merck & Co.; Bernard J. Entner, Fischer Baking Co.; William Hillman, Jason Miller, and Edward O'Hanrahan, all of E. F. Drew & Co.; and James O'Brien.

**Pacific Northwest Section's** September News Letter contains a report from Otho Skaer, chairman of the Advisory Committee to the Wheat Quality Laboratory, that commercial milling of the semidwarf CL-13448 has been called off this year; it is not suitable for milling. It will, however, be milled next year if all goes well.

**Chesapeake Section's** dinner meeting on Sept. 29 in Baltimore presented as speaker Sutton Redfern, head of Cereal Chemistry Division, Fleischmann Laboratories of Standard Brands, speaking on "Yeast in dough and brew fermentation." This was preceded by a trip through the National Brewing Co.'s plant, for intellectual stimulation leading to a more appreciative understanding of the lecture. Dr. Redfern discussed the various components of fermentation, involving the sugars and proteins.

Incorrectly reported in the September issue were the meeting place and dates. The section meets at the Oriole Tower Restaurant, Baltimore, on December 1, Jan. 12, and the last Thursday February through May.

# the President's Corner



## news of the association

As this goes to press, the local sections of your Association are busy with their fall meetings. The Northwest Section met in Minneapolis, Minnesota, on September 30; the Pioneer, Kansas City, and Nebraska Sections met in Manhattan, Kansas, and the Cincinnati Section met with the Association of Operative Millers in Indianapolis, Indiana, on October 7 and 8. This is good, for it indicates the Association is actively engaged in providing service of one kind or another to its members. It was my pleasure to be in Minneapolis where I renewed acquaintances with many friends.

The Tri-Section meeting in Manhattan perhaps merits special mention. The Association's Technical Committee on Particle Size Analysis presented a very comprehensive symposium on this subject. Certainly, particle size analysis has become important to many phases of our industry. Again, this points to the important contributions of our Association to the welfare of industry.

One of our members, C. H. Bailey, has been given the Charles F. Spencer Award for 1960, including a gold medal and \$1,000. Our congratulations are extended to Dr. Bailey for this fine recognition for services to the agricultural sciences.

There is a great deal of complacency among the people in America regarding civil defense, including, unfortunately, many who are in the food industry. It would appear that we as cereal chemists should be made aware of our role in the event of an atomic, biological, or chemical warfare attack. To this end, your Association is joining the Department of Health, Education, and Welfare, Washington, D. C., in planning a Civil Defense Training Course for the food industry, to be held in Dallas immediately following our annual meeting in April, covering a day and a half. This will be the first such training course offered in the U. S. It will include study of vulnerability of food plants, protection against sabotage, use and care of radiation detection apparatus, and the solving of problems created by atomic, biological, and chemical warfare. Plan now to attend this training session.

JOHN A. JOHNSON

### AACC COMMITTEE ACTIVITIES

Under "Association Committees" and "AACC Technical Committees" for 1960-1961, the following

## SPACE AGE FLAVORS...



This is the day of jet-flight and dehydrated potatoes; atomic energy and frozen bread; super-sonic speed and "quicker-than-instant" mixes for everything from soups to desserts. This is the threshold of the space age and the era of convenience foods. Flavors for these modern foods must be as dynamic as the technology of their formulation . . . as carefully designed as the science that developed them. Yet, these space-age foods must still retain that home cooked taste. Only a company that keeps thoroughly abreast of the newest developments in food can give you this kind of "built for the product" flavor. Fries & Fries provides you with space-age flavors with that country kitchen taste! Let our laboratories show you what dynamic flavor research means.



Cincinnati 110 E. 70th St. New York 418 E. 91st St.

were incompletely or incorrectly listed in the September 1960 issue of CEREAL SCIENCE TODAY, beginning on page 221 (Vol. 5, No. 7):

#### **Association Representatives**

Food Protection, W. F. Geddes; International Association for Cereal Chemistry, J. A. Shellenberger; Agricultural Research Institute, Lawrence Zeleny; American Association for Advancement of Science, Clinton L. Brooke

#### **Organic Acid Analysis**

C. A. Watson, *Chairman*; J. Brent Adair, K. L. Fortmann, David F. Houston, J. F. Lawrence, G. J. Servadio, Lazare Wiseblatt

#### **Oxidizing and Bleaching Agents**

Meade C. Harris, *Chairman*; D. K. Cunningham, C. G. Ferrari, K. A. Gilles, C. B. Gustafson, I. Hlynka, V. E. Munsey

#### **Sanitation Methods**

O'Dean L. Kurtz, *Chairman*; Bertha M. Anzulovic, J. V. Corbishley, Ross Cory, Marion Dockett, Robert B. Kilborn, Thomas McCormack, Paul J. Marek, Leota B. Parrack, Jeff Schlesinger

#### **Technical Policy**

Kenton L. Harris, *Chairman*

• • • •

### **REPORTS**

#### **Sanitation Methods**

1. Insect fragment training series: This personalized training series has been in effect since January 1960. We are now in the second quarter series. The present reviewers are: Paul J. Marek, Ross Cory, Bob Kilborn, Thomas McCormack, O'Dean L. Kurtz.

This program has been received with considerable enthusiasm and the participants, representing mills, bakeries, state and federal laboratories, private testing laboratories, and canning companies now number about 70. The program will remain in force as a service of the AACC as long as active interest remains. The training series will replace the National Check Sample for insect fragments as a result of the recommendation of the Sanitation Methods Committee and the vote of the Technical Policy Committee at the Chicago meeting, May 1960.

Comparison of Extraction Methods: There are many diverging opinions on extraction methods, regarding recovery, ease, time, expense, etc. There seem to be relatively few basic methods, but as many modifications as there are analysts using them. We hope to resolve these problems. We are especially anxious to have results on this phase of our program as quickly as possible and thus be in a position to make final, clear-cut recommendations for the revised *Cereal Laboratory Methods*. Collaboration will remain within the Sanitation Methods Committee.

X-Ray Technique and Radiographic Interpretation: The X-ray testing of cereal grains for internal infestation is receiving more and more attention. There is a need to standardize this method and to train those new to the field. Fortunately several on the committee have had considerable experience in this method of testing cereal grains. It has been sug-

gested that a training program be developed for the AACC membership and other interested persons.

Annual Insect Fragment Workshop: We have had many inquiries about plans for follow-up of the three sanitation schools (San Francisco - New York - Chicago) sponsored by the AACC in 1958 and 1959, and many requests by participants and others for the laboratory training manual designed specifically for the three schools. Because of considerable turnover in personnel working in this field, a planned program of specialized training is desirable. It has been proposed that a formal 2- or perhaps 3-day workshop be scheduled immediately before or after the 1961 annual meeting and that a manual of instruction in insect fragment analysis be developed for this purpose. Your detailed suggestions are desired.

O'DEAN L. KURTZ, *Chairman*

#### **National Check Sample Service**

On May 8, 1915, eleven cereal chemists from the Kansas area met in Kansas City, Missouri, and founded the American Association of Cereal Chemists. One of their prime objectives was to establish standard methods of procedure for cereal laboratories. Four samples were distributed among the members during the first year of the organization and the analytical results were compared at the annual convention held in St. Louis in May, 1916. Much emphasis was placed on the use of standardized procedures.

In later years a National Check Sample Service Committee was appointed. The purpose of the Committee was to make flour and feed check samples available to any member of the Association for various analyses. A small fee was charged to cover the mailing of the samples. Each subscriber to the service was requested to send his analysis of the check sample to the Committee for tabulation. A coded copy of the tabulation was then sent to each subscriber. This comparative report was intended to check the reliability of the approved standardized procedures and also to check the accuracy of the individual subscriber.

The Check Sample Service Committee today continues to follow the same procedure as was outlined by the original committee. However, several additional services have been made available to the subscribers and a statistical analysis of the 1958-59 series has been completed. The Statistical Analysis shows a greater deviation between laboratories, as compared to duplicate determinations within a given laboratory. The results of the study are being forwarded to the Technical Policy Committee of the AACC for further study.

The following services are now available:

*Service A.* Monthly hard wheat flour sample for ash, protein, moisture, maltose, gassing power, thiamine, and riboflavin.

*Service B.* Same as Service A, except bimonthly.

*Service C.* Bimonthly soft wheat flour sample for ash, protein, moisture, pH, and viscosity.

*Service D.* Bimonthly feed sample for ash, protein, moisture, fat, fiber, calcium, phosphorus, and occasional special analysis.

Service HS. Bimonthly sample for farinograph (small bowl).

Service HL. Bimonthly sample for farinograph (large bowl).

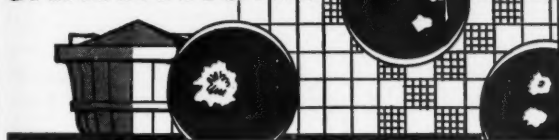
Service I. Bimonthly sample for amylograph.

The Committee has been advised to discontinue Services E and F at the end of the 1959-60 series. The 1960-61 series will start in October, 1960.

Any AACC member may subscribe to the check sample service by writing the Doty Technical Laboratory, 1435 Clay Street, North Kansas City, Missouri, for the necessary details.

LESTER H. FISCHER, *Chairman*

## SANITATION



Sanitation work by the AACC over the past several months has revolved around the work of the Sanitation Methods Committee and their insect fragment training series. This has involved the teaching of the fundamental micromorphological characteristics by which insect pieces can be recognized and identified. This training series is a natural outgrowth of the 1959 training schools and through the Association has brought to the industry a scientifically sound plan for attaining proficiency in this work.

At the same time, it has served to emphasize the service potential of the AACC. The training series (also, of course, the Farinograph Workshop and Laboratory Manual sponsored by the Physical Testing Methods Committee) has clearly demonstrated that our Association is in a position to provide a service to the industry (members and nonmembers alike) in technical laboratory operations. It is suggested that the service feature be extended to other areas. By doing so we will be of major benefit to the entire industry in areas where we have technical proficiency, and will accordingly bring about growth in the AACC.

The Food and Drug Laboratory Manual of Filth and Decomposition Methods (Microanalytical Manual) has been issued in a completely revised form. While copies are not available for general distribution, individuals having interest in a specific area may consult the Manuals in any one of the eighteen District Offices of the Food and Drug Administration. The 7th edition of *Cereal Laboratory Methods* will contain the latest methodology from this Laboratory Manual, the AOAC Book of Methods, and the methodology of our own Sanitation Methods Committee.

Attention is called to the availability of "Microscopic-Analytical Methods in Food and Drug Control" from the Superintendent of Documents, Washington, D. C., price \$2.00.

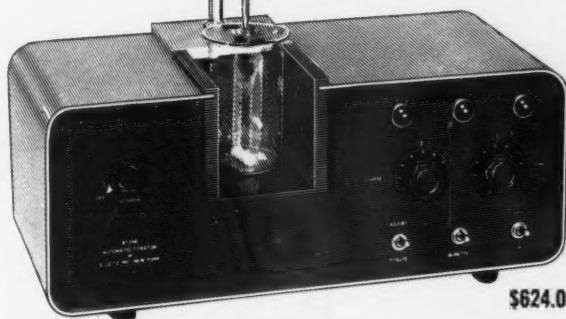
KENTON L. HARRIS

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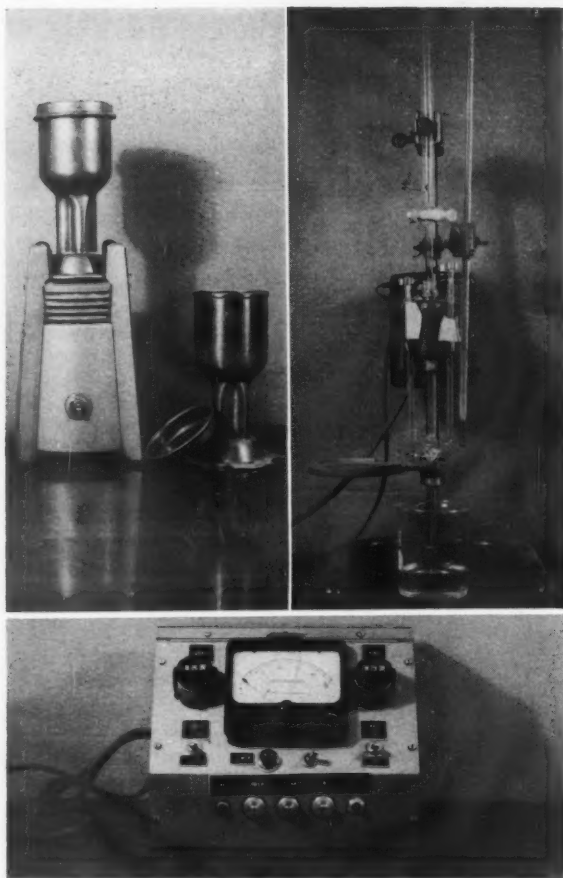
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### RAPID METHOD FOR QUANTITATIVE ESTIMATION OF FLOUR IN PREPARED MIXES

The flour test was developed to provide a check on the formulation of prepared mixes before these mixes are packaged. The procedure is based on more time-consuming chemical determinations for amylose published by Larson, Gilles, and Jenness (*Anal. Chem.* 25: 802; 1953) and by Bates, French, and Rundle (*J. Am. Chem. Soc.* 65: 142; 1953). The test can be run in 5 minutes, but sensitivity and reproducibility have been compromised to gain this speed. It is used as a control test rather than a specification acceptance test.

The method consists of weighing 5 g. of mix into a micro-blender jar (see photo, top left). Next, 100 ml. 0.5N potassium hydroxide are added and blended for 30 seconds. Ten g. of the dispersion are added to a 250-ml. beaker, then the following are added in order: 75 ml. water, 10 ml. N hydrochloric acid, and 5 ml. 0.4N potassium iodide. This is titrated at 3 ml. per minute with 0.001N potassium iodate, with the automatic titrator described below. The ml. of iodate required to reach the end-point and the final sample temperature are recorded.



The titrator assembly (see photo, top right) consists of a titration head with an internal shut-off solenoid, stirrer, and two platinum ring electrodes. One electrode has an externally applied potential of 250 mv. by means of a dry cell and variable resistor to simulate the action of a saturated calomel electrode. The current flow during the reaction can be followed on a microammeter in the circuit. This meter is mounted in the control box shown in the photo. Another dry cell and resistor apply a bucking potential to the meter so that the reaction starts near zero microamp scale reading. A contact needle is manually set at 30 microamps so that the titration is stopped automatically at that point. Once the procedure is standardized, the settings of both potentials and the contact needle are not changed. A 10-second time-delay relay switch is used to start the titration, to allow mixing of the sample before delivery of the iodate. The dry cells, variable resistors, and relay are all included in the control box.

At the beginning of the titration, as iodate is added free iodine is formed which complexes with the amylose in the flour. An increment of iodine causes a small rise in current flow. When the available amylose is exhausted, the current flow increases more rapidly with additional increments of iodate. In the analytical procedure the break point is determined by plotting the titration curve. Since the amylose-iodine reaction acts as though it were stoichiometric, this break point allows accurate determination of amylose. In the flour test, a point beyond the break point of any

sample in the range of interest is selected arbitrarily. The greater the flour percentage, the more iodate is required to pass the break point and arrive at this value.

In the analytical procedures, small increments of iodate or iodine are added and the reaction is allowed to come to equilibrium. Readings are taken after each increment and plotted. The continuous titration in the flour test never allows complete equilibrium, so flow rate of iodate must be reproducible. Also, a relatively large quantity of amylose is present in the sample compared to the analytical procedure. This higher level and the aliquot weighing allow a large enough sample size to ensure sufficient uniformity to establish effective control limits.

The analytical procedures reproduce to an order of magnitude of tenths of a percent, while the flour test has 2-sigma reproducibility of 0.52 ml. or about 2% flour. Two-sigma limits are practical since a recheck can be run quickly, and investigation of the sample history is relatively inexpensive. The temperature correction is  $-0.028$  ml. per  $0.1^{\circ}\text{C}$ .

Titration limits are based on testing known samples. These limits must be determined for each formulation. Mix containing shortening has a lower titration value than would be expected on the basis of titrations of mix without shortening. However, shortening seems to help the sample disperse. Non-shortening-containing material tends to clump, which causes inaccurate readings.

The flour test requires considerable technician training since it is comparatively complicated. Technicians must be careful when dispersing their samples in the hydroxide, must add reagent carefully, and must keep the electrodes clean. However, the test does provide an estimate of flour content in about 5 minutes.

ROBERT G. PIPPITT

*The Pillsbury Co.  
Hamilton, Ohio*

#### QUICK METHOD FOR DETERMINING DIASTATIC ACTIVITY

The diastatic activity of a flour, as normally determined, can be defined as "mg. maltose produced by a 10-g. sample of flour in 1 hour of digestion at  $30^{\circ}\text{C}$ ." More maltose can be produced by either increasing the digestion time or raising the temperature of the water bath. Also, decreasing the digestion time and raising the water-bath temperature produces a compensating effect on the amount of maltose produced.

As a shorter testing time was needed for closer control to mill time, this study was made to determine whether the amount of maltose produced in 30 minutes at  $40^{\circ}\text{C}$ . could be sufficiently correlated to that produced in 1 hour at  $30^{\circ}\text{C}$ . If the correlation were sufficiently large, then the amount of maltose produced by the defined method (1 hour at  $30^{\circ}\text{C}$ .) could be predicted from that produced by the revised method (30 minutes at  $40^{\circ}\text{C}$ .) This would reduce the testing time by 30 minutes.

The defined method used was the official method

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as outlined in *Cereal Laboratory Methods*. The revised method differed from the defined method only in digestion time and temperature. As in the defined method where the buffer solution, prior to use, is held at digestion bath temperature (30°C.), it was also necessary in the revised method to hold the buffer solution at digestion bath temperature (40°C.). Also, samples were shaken at 10-minute intervals during 40°C. digestion as compared to the 15-minute-interval shaking required in the defined method.

Figure 1 shows the digestion bath and the boiling-



Fig. 1. Left to right: cold-water bath, boiling-water bath, and digestion bath.

and cold-water baths, all of stainless-steel construction. The lead rings on the flasks in the digestion bath prevent any floating or overturning of flasks. The test tube rack containing a number of samples can be very quickly transferred from the boiling-water bath to the circulating cold-water bath for cooling. A stainless-steel gabled top (not shown) fits on the boiling-water bath, preventing an excessive loss of steam, and also reduces time to boiling when bath is turned on.

Figure 2 shows a lazy-susan type of filtering rack for filtering of samples after digestion. This round, revolving rack of Plexiglas construction requires

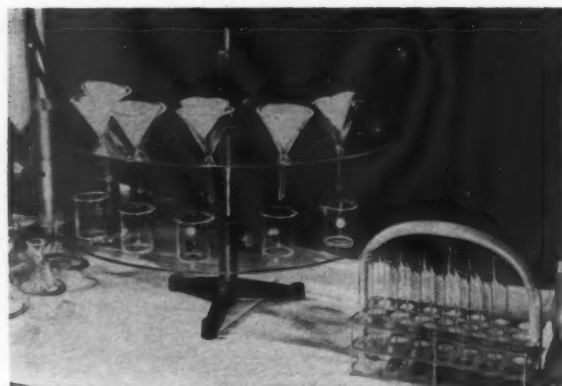


Fig. 2. Filtration rack.

a minimum of space and gives an excellent view of all samples filtering. The combined equipment lends itself to handling a large number of samples at one time.

Each day for approximately a month the first-, second-, and third-shift technicians tested samples of flour by both the defined and the revised procedures.

The number of mg. of maltose produced by a 10-g. sample was reported for each of these analyses. The range of maltose was 130 to 400 mg. per 10 g. as determined by the defined method. A total of 223 pairs of samples were tested by both the defined and revised methods.

Figure 3 is a scatter diagram of maltose values for

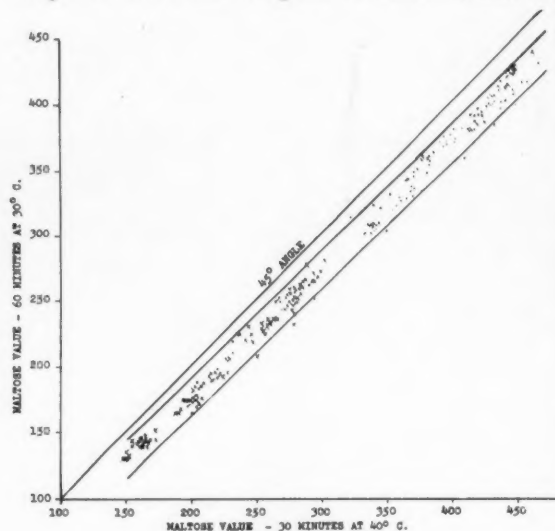


Fig. 3. Maltose values.

the 223 pairs of samples. The maltose values corresponding to the defined method were plotted along the vertical axis and those corresponding to the revised method along the horizontal axis. The space between the two slanting lines contains approximately 95% of all the coordinate pairs.

Figure 4 contains the prediction line for the set of

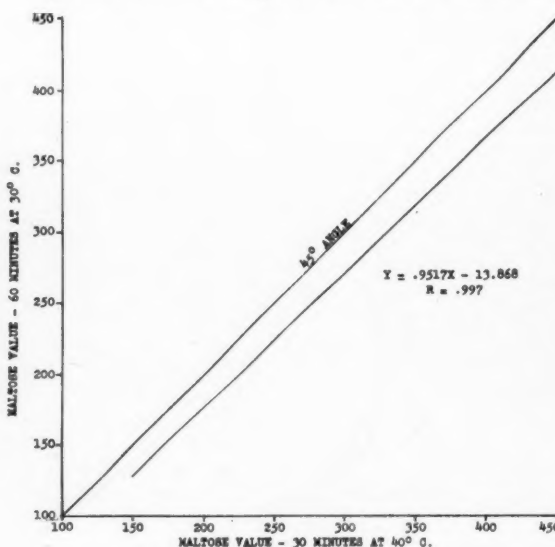


Fig. 4. Prediction line.

data. Its equation is  $Y = 0.9517X - 13.868$  with a correlation of  $r = 0.997$ . (Both X and Y were determined by table for the defined method.)

The high correlation emphasizes the fact that the two methods were linearly related throughout the entire range of samples.

Table I. 40°C. Water Bath — 30 Minute Digestion Time

Thio-Sulfate, .04N	Maltose/ 10 g. Flour	Thio-Sulfate, .04N	Maltose/ 10 g. Flour	Thio-Sulfate, .04N	Maltose/ 10 g. Flour	Thio-Sulfate, .04N	Maltose/ 10 g. Flour
ml		ml		ml		ml	
1.0	546	5.0	429	9.0	329	13.0	230
1.1	542	5.1	426	9.1	326	13.1	228
1.2	539	5.2	424	9.2	324	13.2	226
1.3	535	5.3	421	9.3	321	13.3	224
1.4	531	5.4	418	9.4	319	13.4	221
1.5	527	5.5	416	9.5	316	13.5	218
1.6	523	5.6	414	9.6	313	13.6	215
1.7	519	5.7	412	9.7	312	13.7	212
1.8	517	5.8	409	9.8	309	12.8	209
1.9	514	5.9	406	9.9	307	13.9	208
2.0	510	6.0	403	10.0	304	14.0	206
2.1	506	6.1	401	10.1	302	14.1	203
2.2	503	6.2	398	10.2	300	14.2	201
2.3	500	6.3	395	10.3	297	14.3	198
2.4	498	6.4	394	10.4	295	14.4	196
2.5	495	6.5	391	10.5	292	14.5	193
2.6	492	6.6	388	10.6	290	14.6	191
2.7	489	6.7	386	10.7	287	14.7	188
2.8	486	6.8	383	10.8	284	14.8	186
2.9	483	6.9	381	10.9	282	14.9	185
3.0	480	7.0	378	11.0	279	15.0	183
3.1	478	7.1	375	11.1	276	15.1	181
3.2	476	7.2	372	11.2	274	15.2	178
3.3	473	7.3	371	11.3	271	15.3	176
3.4	470	7.4	368	11.4	270	15.4	173
3.5	467	7.5	365	11.5	267	15.5	171
3.6	464	7.6	363	11.6	264	15.6	168
3.7	461	7.7	360	11.7	262	15.7	166
3.8	459	7.8	357	11.8	259	15.8	164
3.9	457	7.9	355	11.9	257	15.9	162
4.0	455	8.0	352	12.0	254	16.0	159
4.1	452	8.1	351	12.1	252	16.1	157
4.2	450	8.2	349	12.2	250	16.2	155
4.3	447	8.3	347	12.3	248	16.3	152
4.4	444	8.4	344	12.4	246	16.4	150
4.5	441	8.5	341	12.5	243	16.5	148
4.6	439	8.6	339	12.6	240	16.6	146
4.7	436	8.7	336	12.7	238	16.7	144
4.8	434	8.8	333	12.8	235	16.8	143
4.9	432	8.9	332	12.9	233	16.9	141

*Summary.* For any maltose value determined by the revised method, the corresponding value for the defined method can be found graphically from the prediction line, or arithmetically by substituting the value determined by the revised method for X in the above equation and solving for Y. The preparation of a table to give the predicted maltose value for various 0.1-ml. increments of thiosulfate titrated is much more convenient to use. Table I gives the predicted maltose results in the range of 141 to 546 mg. per 10 g.

With the revised method it was found possible to shorten the maltose testing time by use of higher temperature and shorter digestion time without sacri-

ficing reliability or accuracy.

The revised method has been accepted for use in the Springfield laboratory, and over an extended period of time has proven very satisfactory.

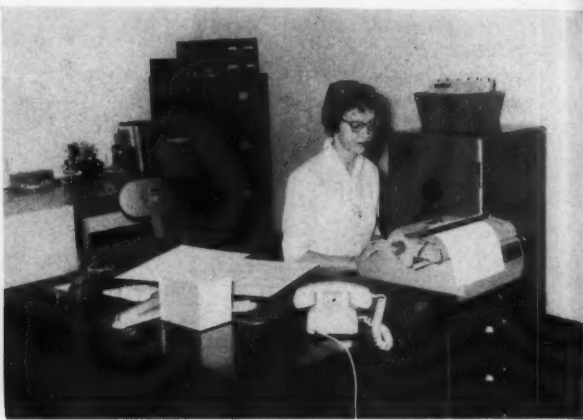
This study was a collaborative effort made by the Quality Control Department of the Springfield, Illinois, plant of The Pillsbury Company. Recognition is given to E. C. Swanson who directed the study and to all others who participated in it.

R. S. TERRELL

*The Pillsbury Co.  
Springfield, Illinois*



This is the scene that greets visitors on entering the AACC office.



Mrs. Doreen (Christenson) Rentz at her desk using the new IBM electric typewriter. Mrs. Rentz has been an employee of the Association since November 1950 and serves as office manager and bookkeeper.



The Executive Secretary's office showing the layout table used to "paste up" the "dummy" for each issue of CEREAL SCIENCE TODAY.

Mrs. Genevieve DeRemee preparing a few address changes on the AACC's mailing list. Mrs. DeRemee has been with the AACC since March 1951 on a part time basis. She keeps the mailing stencils up-to-date and operates the Addressograph in addition to routine work.



## 1955 University Avenue

*The AACC's new address since June 1959. We thought some of our members might be interested in visiting the office and meeting the staff. Here are a few shots taken last summer showing each of the three main work areas totaling some 720 sq. ft. Not shown in these pictures is the office of Mrs. Eunice Brown, our Technical Editor, who works at home.*

Another part of Mrs. DeRemee's domain. In the background can be seen part of the mailing table where all AACC mailings are assembled and tied for the post office. The folding machine (center) and the mimeograph (right) are essential to this type of operation.



*The  
Officers and Directors  
of the  
American Association of Cereal Chemists*

extend a cordial welcome to following individuals

who have recently joined the AACC

ANTILA, MATTI TAPIO, *Director of Central Laboratory, Raisio Tehtaat Oy, Raisio, Finland.*

BECKER, CHARLES A., (Sheffield Chemical Co.), Fuller Road, Norwich, New York.

BECKHORN, EDWARD J., *Director of Research, Wallerstein Company, Wallerstein Square, Staten Island 3, New York.*

BURLAND, RONALD J., Post Division, General Foods Corp., 275 Cliff St., Battle Creek, Michigan.

DOCKETT, MARION V. (Mrs.), The Pillsbury Company, 116 S.E. 3rd St., Minneapolis 14, Minn.

ENTNER, BERNARD J., (Fischer Baking Co.), 45 Douglas Rd., Glen Ridge, N.J.

FETHERSTON, T. R., Knickerbocker Mills Co., 601-621 West 26th Street, New York 1, New York.

FLEMING, JAMES R., Dept. of Flour & Feed Milling Ind., Kansas State University, Manhattan, Kansas.

FONG, WING SIEN (DCA Food Industries, Inc.), c/o Mr. Franz Weissblatt, 5811 Empire State Bldg., 350 Fifth Avenue, New York 1, New York.

HAN, YONG-SUK, *Director, Food Industry Section, National Industries Research Center, 199 Tongsoong-dong Chongnokoo, Seoul, Korea.*

HARTMANN, MAGNUS K., Ogilvie Flour Mills, Winnipeg, Manitoba, Canada.

HOOVER, WM. J., *Manager, Technical Services, Corn Industries Research Foundation, 1001 Connecticut Ave., N.W., Washington 6, D.C.*

KURDYCK, J. GEORGE, *Supervisor, Animal Nutrition Lab., Canadian Agricultural Research Station, Lethbridge, Alberta, Canada.*

LAAKSONHEIMO, JARMO TAPIO, *Head, Cereal Lab., Raisio Tehtaat Oy, Raisio, Finland.*

LAX, JACOB, (Joe Lowe Corp.), 2744 E. 11th St., Los Angeles 4, Calif.

LEE, DAVID, 711 Front Street, Hamilton, Illinois.

LOUDERBACK, LAUREN G., *Manager of Quality Control, (Ralston Purina Co.), 835 South 8th Street, St. Louis 2, Missouri.*

MONROY, ARMANDO, Apartado Post. 25, Toluca, Mexico.

MOSHY, RAYMOND, *Group Manager, American Machine & Foundry Co., 689 Hope Street, Springdale, Conn.*

MYERS, C. RICHARD, *Branch Manager (Firmenich & Co.), 612 N. Michigan Avenue, Chicago, Illinois.*

NELSON, JOHN H., *Research Biochemist, (General Mills, Inc.), 7537 18th Avenue So., Richfield 23, Minn.*

PARRACK, LEOTA B. (Mrs.), *Control Analyst (Archer-Daniels-Midland Co.), 2730 Portland Ave. So., Apt. 108, Minneapolis 7, Minnesota.*

PIPPITT, ROBERT G., *Quality Control Manager, Feed Division (The Pillsbury Company), 6041 Penn Ave. So., Minneapolis 19, Minn.*

POLLAK, EDMUND C., President, Flour Mix Co., Inc., 33-52 62nd St., Woodside 77, New York.

POMERANZ, Y., Dept of Flour & Feed Milling Ind., Kansas State University, Manhattan, Kansas.

POWELL, EUGENE L., *Assistant Director of Research, American Maize-Products Co., Roby, Indiana.*

PUTNAM, ROBERT C., *Chief Chemist, United States Testing Co., Inc., 1415 Park Avenue, Hoboken, New Jersey.*

ROWE, CHAS. S., *Ass't Manager, Atlas Powder Company, 135 So. LaSalle St.—1606, Chicago, Ill.*

RUSH, JOHN V., *Technical Sales Representative (Firmenich & Co.), 14530 So. Union Ave., Riverdale 27, Ill.*

SMITH, DONALD E., General Mills, Inc., Central Research Laboratories, 2010 E. Hennepin Ave., Minneapolis 13, Minn.

STONE, IRWIN, *Supervisor of Brewing Research, Wallerstein Company, Wallerstein Square, Staten Island 3, New York.*

STRINGER, PAUL W., *Assistant Chemist, Laboratory, Maple Leaf Milling Co., Port Colborne, Ontario, Canada.*

TANILLI, VICTOR H., National Biscuit Co., P.O. Box 1528—Central Station, Toledo 3, Ohio.

THOMAS, M. J., *Technical Sales Rep., Swift and Company, 4115 Packers Ave., Chicago 9, Ill.*

TOLIN, STANLEY, *Vice President and General Manager, (Vico Products Co.), 415 W. Scott St., Chicago 10, Ill.*

UNITED SALT CORPORATION, Attn: L. F. Van Stone, *Executive Vice Pres., 4614 Montrose Blvd., Houston 6, Texas.*

YAZU, NORIYUKI, 400 Kamisakabe, Amagasaki City, Japan.

WASHINGTON, ROBERT C., Sterwin Chemicals, Inc., 1125 Merriam Lane, Kansas City, Kansas.

ZIEGLER, EDWIN, Waldstr. 10, Zollikerberg, Near Zurich, Switzerland.



## BOOK reviews

**Nutritional Evaluation of Food Processing**, ed. by R. S. Harris and H. von Loesecke. Wiley, New York, 1960. Price, \$12.00. Reviewed by PAUL A. BUCK, Cornell University, Ithaca, N.Y.

The editors have compiled a worthwhile book for most people interested in phases of food, food processing, or nutrition, by including many needed review articles written by known authors. The book is outstanding for the breadth of its coverage on the effects of the processing of food on human nutrition.

Basically, nutrition is biochemical research, whereas changes of food during processing come under the head of analytical chemistry. Seldom do these fields of nutrition and of evaluation of nutritional changes attract the interest of both nutritionist and chemist, yet these editors integrate enough biochemistry and food technology to interest the food scientist and the nutritionist, and they supply adequate tables and references to interest the food chemist.

The subject does not have much new, dynamic information; however, an interesting, worthwhile book has been achieved. The main purpose seems to be integration of knowledge about nutritional effects of the processing of food, knowledge that has been available but widely dispersed. This book not only achieves this aim but also will facilitate further research by indicating the complexity of changes during growing, harvesting, storage and processing.

The book fittingly stresses the genetic and environmental influences on the nutritional level of food in the opening chapter. The

important role of post-harvest physiology is adequately discussed before the changes caused by processing are detailed. The often overlooked loss in nutrients during home utilization of processed food is discussed.

The bibliography for each chapter is extensive and up to date. The literature has encompassed work in other parts of the world as well as the work in progress in America.

Bioassays and chemical tests have not been discussed. If these methods had been adequately covered, then the capability of such tools as microorganisms in a bioassay to become a part of quality control would have been advanced, and food processing could have been placed under more sound nutritional control. Nonchemists and nonbiochemists will have difficulty in visualizing the application of nutritional control to food processing, so that the book misses one phase of educational value by not including more information on such methods. Diet selection should include nutritive quality along with color, flavor, and texture qualities, and adequate control of nutrients must be considered along with present or future controls on color, flavor, and texture.



**Methods of Biochemical Analysis**, vol. 8; David Glick, editor. Interscience Publishers, Inc., New York, 1960; 360 pp. Price \$10.00. Reviewed by JOHN H. NELSON, University of Minnesota, St. Paul, Minnesota.

This eighth volume in the series contains reviews on the following methods of biochemical analysis:

qualitative and quantitative determination of fatty acids by gas-liquid chromatography; measurement of luciferin and luciferase; enzymic analysis of steroid hormones; aliphatic ammonium salts in the assay of acidic polysaccharides from tissues; isolation and determination of neuraminic acids; determination of porphyrins in biological materials; *in vitro* frog skin assay for agents that darken and lighten melanocytes; and principle and method of heatburst microcalorimetry and the determination of free energy, enthalpy, and entropy changes. The principles involved in these methods are explained well and many applications of each method are discussed.

Cereal chemists will find the chapter by A. T. James particularly useful. This discussion of the qualitative and quantitative determination of the fatty acids by gas-liquid chromatography is excellent, in that Dr. James, a pioneer in this field, has organized in logical form much of the information necessary for a working knowledge of the technique.

The section dealing with the preparation of the gas-liquid chromatogram contains many useful suggestions and helpful tabular material, as well as words of caution concerning possible problems that might be encountered. A variety of methods of extraction, saponification, and esterification are presented. Factors controlling separation of the fatty acids are discussed and a table is included which presents the generalized effect of changes in molecular structure of the fatty acids on retention volume. Other sections of this review are: Separation of fatty acids; Quantitative determination of fatty acids; Identification of the fatty acids; and Determination of the radioactivity of labeled fatty acids.

Nature-loving cereal chemists may be interested in the second review, which discusses bioluminescence such as that produced by the luciferin-luciferase system in the firefly. The discussion of heatburst microcolorimetry in the final chapter contains a section dealing with biochemical applications of this technique which will be of interest to the cereal chemist interested in new and advanced fundamental research techniques. The vol-

ume contains subject and author indexes and cumulative indexes for volumes I through VIII.

This volume is recommended as a well-written addition to the series.

■ ■ ■ ■

**Advances In Agronomy, Vol. XI.** Edited by E. G. Norman, Academic Press, New York, N.Y., 1960. Price, \$12.00. Reviewed by W. H. WADDELL, Ontario Agricultural College, Guelph, Canada.

This excellent volume appears to be of the same high quality and usefulness as the previous volumes of the series.

The main topic is a review entitled "Water and its relation to soils and crops," occupying more than one-quarter of the book. This section is a departure from the usual procedure, in that it was prepared by a group of co-authors under the sponsorship of a committee of the Agricultural Board of the National Academy of Sciences.

The main purpose of the review is to focus attention on the nature and importance of the interrelations of the soil-plant-water system. Although emphasis is placed on conditions which obtain in the United States, no doubt the principles discussed would have significance over a much greater part of the world.

Another section deals with the economics of fertilizer use. It is pointed out that in recent years there has been a tremendous increase in the use of commercial fertilizers, but in many cases the fertilizers have not been used at the most profitable rates for a particular soil. Research work has

been conducted with a view to solving the problem of proper use of fertilizers and the results of such research are set forth by the interesting method of "isoquants."

Agricultural machinery is of interest to the farmer, the engineer, the agronomist, and the equipment manufacturer. The most rapid advance is made when all four combine to improve the machinery used on the farm and in experimental plots. Examples are given of the results of teamwork in projects varying as widely as the baling of hay and the harvesting of tung nuts.

Another lengthy section deals with fertilizer production and technology. This subject was discussed in volume I (1949) of this series, and the section in the present volume reviews the work done since that time. During this interval the use of primary plant nutrients—nitrogen, phosphoric oxide, and potash—supplied by commercial fertilizers has doubled throughout the world and has increased by 75% in the United States. New and promising manufacturing techniques are described, as well as new products which have been discovered and put into use and older products which have undergone improvement.

The final section deals with soils and land use in The Netherlands. Although conditions there are unlike those in America, this section is of interest since it describes the excellent method of intense cultivation and soil improvement in an area of dense population. The acquisition of productive land for towns, villages, ports, roads, airports, etc., is important in any

country but particularly so in this highly developed agricultural area.

It would appear that volume XI of this series should be of great interest to research workers in the field of agronomy.

■ ■ ■ ■

**Corn in Industry, 5th ed.,** revised and up-dated in text and illustrations (64 pp.). Corn Industries Research Foundation, 1001 Connecticut Ave. NW., Washington 6, D.C. Available on request, no charge.

This book describes how corn kernels are taken apart to make starch, syrup, sugar, oil, and feeds, and how these products enter into the manufacturing processes of scores of food and nonfood industries. The opening chapter traces corn's contribution to American agriculture and commerce, from farm to finished products, including foods, paper, textiles, adhesives, and many other things; corn products enter into much of the food and equipment used by the armed forces. The book concludes with a look at the future and potential new uses for corn.

■ ■ ■ ■

**Chemicals and the Food Industry,** by Robert M. Ikeda and Donald G. Crosby. Calif. Agr. Exp. Sta., Extension Service Manual 26 (June 1960). Price, \$1.00.

A well-written, concise review of the use of chemicals in food processing. Various food products and processing operations are described. A bibliography follows each section. A list of chemicals used by the food industry is appended, classified by function and current status under U. S. regulations.

## *The Preparation of Illustrations and Tables*

J. Ansel Anderson

This famous little booklet is now on its 3rd printing after being off the market for almost a year. Over 2,000 copies have been circulated since its appearance in 1945. Some of the topics covered:

- How to organize your graphs
- What size drawing pen to use
- Bargraphs or histograms
- How to organize data for tables
- When to use leader tables
- Illustrations and tables for visual presentation

Price: \$1.00 — 32 pp.

**AMERICAN ASSOCIATION OF CEREAL CHEMISTS**  
1955 University Ave., St. Paul 4, Minnesota

# People, (Products), Patter

## • • • People

C. Gilbert Aron appointed manager of agricultural chemistry division, Harris Laboratories, Inc.; from chief chemist for Lincoln (Nebraska) Grain Exchange.

C. H. Bailey, dean emeritus of the Institute of Agriculture, University of Minnesota, has been selected as the 1960 winner of the Charles F. Spencer Award. The award, established by the Spencer Chemical Co., is administrated by the Kansas City Section of the ACS. Dean Bailey was the first editor of CEREAL CHEMISTRY, second recipient of the Osborne Medal, and 17th president of the AACC. In 1958 he was elected an Honorary member in the AACC.

Louis Bartenbach appointed to newly created position of experimental chef, product development section, General Foods Research Center; from food director and chief chef instructor at Culinary Institute of America. Eugene Miaszek named project leader, Jell-O division lab of the Center, from assistant technologist in its packaging research lab.

C. B. DeGreen and D. L. Guilian appointed as sales representatives, Chemical Division, Eastman Chemical Products, Inc.; Guilian in industrial and specialty chemicals, New York area; DeGreen in polyethylene resins, southeastern states.



E. R. Durrer, president of Givaudan Corp. and associated companies including Givaudan Flavors Inc., returns from extended European trip visiting Givaudan plants; reports observing a vigorous pace of the economy in Switzerland and in Europe in general.

Norman Foster transferred to Dallas, Texas, U.S. Food and Drug Administration; from Minneapolis offices.

Homer Elling appointed director of research, product development,

and quality control, Roman Meal



Dick Fuhr now with Mothers Cake & Cookie Co., Oakland, Calif.

Co. of Tacoma, Wash.; from USDA's Western Wheat Quality Laboratory, Pullman, Wash., in charge of determining baking quality characteristics of new wheat varieties. Will take over researching of new Roman Meal products and will supervise quality control of baked products produced by some 176 franchise bakeries.

Curtis J. Patterson, a founder and third president of the AACC, was killed September 16 in an automobile accident, at age 71. He lived in Kansas City, Missouri.

Mr. Patterson's efforts contributed greatly to the advance of cereal chemistry and the standing of cereal chemists in the milling and baking industry. He was instrumental in the organization of the American Society of Bakery Engineers of which he became the second president, and of the Midwest Research Institute, whose board of trustees he headed.

Mr. Patterson took a major part in the establishment of three of the ranking baking firms in the nation; his own C. J. Patterson Co. became one of the first to organize a complete testing laboratory. He was a leader in bringing about the purchase of wheat on a protein basis instead of a dry gluten basis; he developed many of the now accepted improvements in flour and bread formulation and in milling and baking methods. At the time of his death he was as active as ever in research.

Terrance Hanold elected vp and treasurer, The Pillsbury Co.; Arthur P. Loomis and J. Cy Rapp,

vp's; and Arthur H. Rixe, controller. Hanold has held legal and financial posts for the company; Loomis will continue to head refrigerated foods division; Rapp continues as chief of Tidy House Products, recently acquired by Pillsbury; Rixe has held accounting and controller positions with the company.

## • • • Products

A new protein-rich soy flour developed by Archer-Daniels-Midland Co., Ardex 550, is said to contain 50 to 55% protein and to be neutral in taste and odor. In bakery products, according to ADM, it enhances "freshness" and crust color; can be used in dry baking mixes. High protein content makes it suitable as milk protein replacement; in a commercial bakery test, 3% of Ardex 550 substituted satisfactorily for 4% of milk solids in white bread; cost saving, 55%. The flour also is said to retard staling; improve texture; make doughs easier to handle and bread doughs more compressible; reduce grease absorption in doughnuts; improve firmness and texture of canned and frozen macaroni products; keep foods firm and fresh-looking longer on the steam table.

Catalog of flavorings. A gold cover sets off the new descriptive catalog and price list (32 pp.) of flavoring, aromatic, and essential oil products offered by Florasynth Laboratories, Inc. Copies are available by writing to 900 Van Nest Ave., New York 62, N.Y. Besides detailing information on the use, quantity, and effectiveness of specific products, Florasynth encourages the reader to make use of the services of its extensive research facilities and personnel in the development and creation of flavorings tailor-made to the requirements of the food manufacturer. Canadian readers should write to Florasynth Laboratories Ltd., 29 St. Paul St. East, Montreal, for copies.

Accuracy of Udy Protein Analyzer. A study made at the Department of Cereal Technology, North Dakota Agricultural College, compared the accuracy of protein tests made by the Kjeldahl method to those made by the Udy Protein Analyzer, and found a correlation of 0.970, according to O. J. Banasik, chairman of the department (1.0 is considered perfect). The research was sponsored by the North



## After and before

Look at these two dishes of "instant" mashed potato. There is only one difference between them.

The one on the left contains  $\frac{1}{2}$  of 1% of *Myverol Distilled Monoglyceride, Type 18-00*.<sup>\*</sup> It looks, tastes, and feels to the palate like just-mashed potato. The one on the right, with no monoglyceride, is a sticky, pasty mess.

No one will be offended by this comparison because as far as we know there is very little, if any, instant mashed potato on the market that does *not* contain monoglyceride. Monoglyceride is one big reason why the instant mashed potato idea has been such a success.

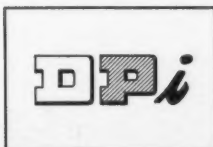
Since all the instant-potato producers must know this already, why do we spend money advertising to them?

Ah, not to them is this ad directed. It is directed to producers of *other* starchy foods who have a stickiness or pastiness problem. We want them to understand the principle: *free amylose, put into solution during cooking, is complexed by high-purity monoglyceride so that its molecules cannot hydrogen-bond themselves into a gelatinous mass.*

Myverol Distilled Monoglycerides are officially recognized as safe. For samples and information on their use, write *Distillation Products Industries*, Rochester 3, N. Y. Sales offices: New York and Chicago • W. M. Gillies, Inc., West Coast • Charles Albert Smith Limited, Montreal and Toronto.

<sup>\*</sup>Type 18-00 is made from hydrogenated lard. Type 18-07 from hydrogenated cottonseed oil gives exactly the same effect.

*distillers of monoglycerides  
made from natural fats and oils*



Also . . . vitamin A in bulk  
for foods and pharmaceuticals

**Distillation Products Industries** is a division of **Eastman Kodak Company**

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Dakota Wheat Commission as part of its wheat improvement program. In summarizing the study, Mr. Banasik also reported that the speed of the Udy method may offer important advantages: protein percentage can be obtained with the Analyzer in about 5 minutes as compared to almost 2 hours required with the Kjeldahl procedure. A more complete report will be released shortly in the Bi-Monthly Bulletin of NDAC. Write to Mr. Banasik (see college and department named above), Fargo, N.D.

**Flavor tidbits: Givaudan.** Users of Oil Anise USP who are seeking to reduce their flavor costs without loss in flavor quality are invited to examine Imitation Anise Flavor F-3479, to be used instead of the natural oil or to extend it. The Givaudan people assure excellent flavor rendition and considerable savings.

To assist food processors in solving their vanilla problems, Givaudan offers Imitation Vanilla Flavor F-2873, a 40-fold liquid concentrate. Samples and use information on both will be sent on request: Givaudan Flavors, Inc., 321 W. 44th St., New York 36, N.Y.

#### • • • Patter

"Food," a brochure issued by Merck & Co., reviews Merck research for the food industry and explains the various services available from the company. The 24-page brochure is illustrated with eye-catching photographs. It outlines the functions of the testing kitchen and of the laboratories—microbiology, chemistry, and applications—and explains how they help solve problems confronting food processors. It also outlines the close relationship between the scientists at the company's food laboratories and its agriculture and animal feeds laboratories, as well as its engineering department. A chart summarizes Merck products used in food processing. Those interested in obtaining a free copy of the brochure may write to Merck & Co., Inc., Rahway, N.J.

**W&T Research center.** Wallace & Tiernan will build a \$750,000 chemical research laboratory in the Town of Tonawanda, N.Y., on the company's property at 1740 Military Road in the township. The single-story, U-shaped building of 20,000 sq. ft. will be divided into ten separate research laboratories

equipped with modern testing facilities, besides the usual complement of library, lunch room, etc. More than 30 research chemists and technicians will move to the new lab from the Military Road plant; vacated space there will be remodeled for the needs of divisional executive offices. The laboratory is scheduled to be completed late next spring and to be in full operation by August 1961.

**ASBC 1961 meeting.** Plans for the 1961 convention of the American Society of Brewing Chemists at San Antonio, Texas, are well under way, directed by Edward L. Roth, general convention chairman. Headquarters will be at San Antonio's Granada Hotel (formerly The Hilton). The dates are April 30 to May 4.

A new publication to help in the task of finding a needle of highly specialized data in the haystack of chemical literature will start in 1961 and appear twice a year—the Journal of Chemical Documentation. A recent estimate has been made that the amount of chemical literature which will be published in the next three years will be equal to, or greater than, all that has been published so far! The new Journal will deal with the process of revealing and using specific chemical knowledge; it will concern itself with the chemist's information needs and habits, aiming to help him know better the literature at his command, and get more out of it.

Editor is Herman Skolnik, manager of the Technical Information Division of Hercules Powder Co. Some articles to look for: "French organic nomenclature"; "Technical translating"; "Detecting corresponding patents from different countries"; "Nomenclature of carbohydrates." (About 50 articles each year.) Price: \$7 a year for ACS members; \$10 for nonmembers. Inquire of Richard H. Belknap, Business Manager, Business Div., American Chemical Society, 1155 16th St. NW, Washington 6, D.C.

**Biological Abstracts** held a housewarming and dedication ceremonies on October 6 and 7, to launch its new \$225,000 headquarters building at 3815 Walnut Street, Philadelphia. The dedication featured a symposium by leading biologists on problems and trends in scientific communications.

## Menger:

(Continued from page 277)

Flour-Bill, only minor modifications are called for in milling and baking now—especially pertaining to antioxidants, emulsifiers, leavening agents, and labeling procedures. It is noteworthy that some paragraphs of the Flour-Bill have been altered, so as to transfer part of their specifications to the newly issued individual regulations and to remove any conflicting passages in the legal text. Their original meaning and impact on the trades, however, remains unchanged.

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## CLASSIFIED

#### SITUATIONS WANTED (AACC Members)

New product development specialist in food field. Chemist with 15 years, successful history in creating well-known nationally distributed products — most of which were "firsts". Presently V.P. of R. & D., seeks top level position, limited only by unlimited imagination. Reply to: Dept. 10E, CEREAL SCIENCE TODAY, 1955 University Avenue, St. Paul 4, Minnesota.

Cereal Chemist and Food Technologist—twenty years of varied and responsible experience in products control, research and product development — excellent background in commercial baking and baking technology; seeks promising position in product development and/or technical service. Reply to: Dept. 10F, CEREAL SCIENCE TODAY, 1955 University Avenue, St. Paul 4, Minnesota.

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